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BOSTON JOURNAL OF COMMERCE AND TEXTILE INDUSTRIES and SOUTHERN MILLS.

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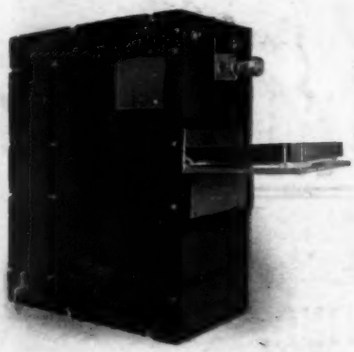

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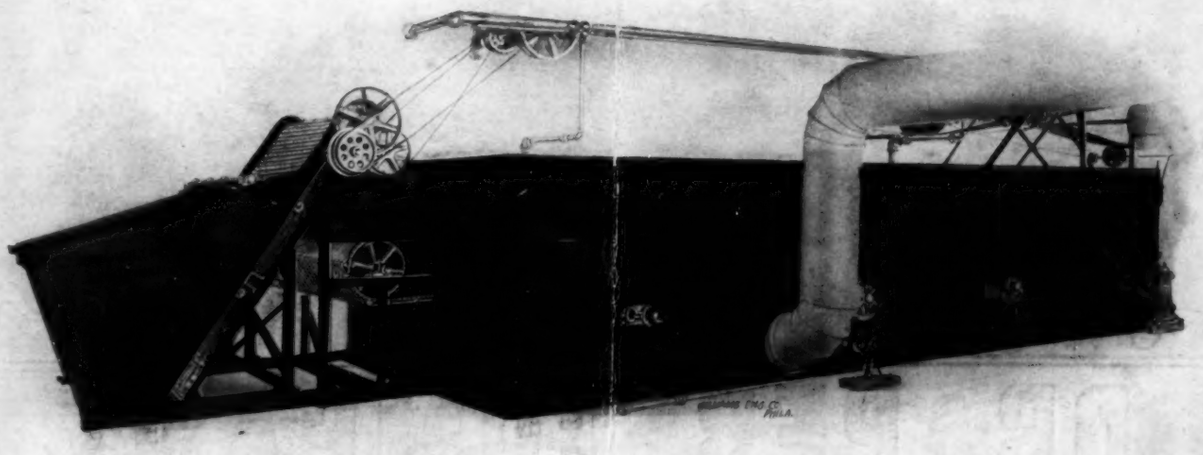

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HENRY W. ATKINSON, EDITOR

W. IRVING BULLARD
H. H. KELLEY
J. A. WELLS
F. C. MYERS
} ASSOCIATE EDITORS.

CONTRIBUTORS

Joseph H. Barker, Alfred Burton, Charles E. Barnhardt, H. R. Carter, Stewart F. Carter, Park A. Dallis, Frederic Dennerth, Chas. Day, D. E. Earle, R. Livingston Fernbach, Jos. H. Hart, Sanderson W. Hayes, F. W. Horrocks, O. F. Ireland, Emil Kahn, Lamar Lyndon, C. L. de Muralt, Thomas Nelson, Will Nelson, Frank Nasmith, David Paterson, Henry Rowe, J. E. Sirrine, Stephen E. Smith, C. O. Terwilliger, John F. Timmerman, Ernest Tompkins, Samuel Ward, William Watson and F. R. Weller.

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COMBINATION, THE SOLUTION OF THE COTTON MILL PROBLEM.

Important economic changes are taking place in the cotton manufacturing industry which has increased in fifty years from a capital investment of $100,000,000 with a product value of $115,000,000, to $700,000,000 capitalization with a product value of $500,000,000, and has become one of the greater fundamental industries of the country. The evolution of the industry from private and individual ownership to partnerships, thence to corporations is a matter of historical and contemporary knowledge; but now the dynamic forces of economy require another evolutionary step. This is imminent.

It is the opinion of a large number of students of industrial economics that existing conditions in the cotton industry justify immediate measures to assist the laws of supply and demand. For eight months, there has been over-production in certain lines of cotton commodities followed by spasmodic and intemperate curtailment. For months, a large proportion of cotton mills in this country have been selling finished goods at prices that hardly met manufacturing costs. Auction sales of napped goods have taken place at prices that showed the manufacturing plants a heavy loss. Spinners of weaving and hosiery yarns have been in the depths of despair ever since raw cotton passed 11 cents per pound. And so one might enumerate unfavorable conditions and circumstances ad infinitum.

There is a corrective measure, however, that can be applied to the cotton industry that will prove a semi-panacea. "Economic combinations" are the magic words. When economists apply their wand to the cotton industry, then profit and peace with great industrial activity will become the outgrowth of present depression and chaos. To consider this subject impartially one should appreciate a few doctrines of economies: First, production should be controlled whenever supply becomes so great as to lower prices below the point where they cover expense of production. This applies directly to the contemporary yarn market, and many lines of coarse goods where the cost of raw materials enters so largely into the cost of the finished products. Independent mills, large and small, can not control production unless there is a united and combined action, such as Fall River manufacturers have recently taken in curtailing production one day each week for an indefinite period. Since all of the print cloths are not made in Fall River, the production of these fabrics is controlled and limited so far as this particular community is concerned. The action of Fall River mills will reduce the production, but theoretically and practically the production is not controlled, so that it will take longer to restore paying prices than if all manufacturers of this particular line of fabrics combined in curtailment. When the United States Steel Corporation sees the necessity of curtailing production, all independent manufacturers of steel commodities are consulted

and a definite curtailment agreement put into unanimous operation.

A logical conclusion from the above reasoning is that a combination of print cloth mills would control production of this line of fabrics. If there were such a combination, would the Algonquin Printing Co. undersell the American and Simpson-Eddystone prints one-half cent per yard, as they did during the last two weeks of February? This cut was entirely unjustified because at 5¼ cents, for which they sold the return did not cover cost of production when based upon current prices of raw materials. Possibly the Algonquin people had a favorable contract for print cloths and saw an opportunity to control the market for prints for a brief time. In another month the Garner interests may turn the tables while the second month may see the American Printing Co. in control of the market. Such an advantage is but ephemeral to the buyer. Eventually the consumer pays the bill because a certain rate of interest must be earned on fixed capital invested, and such price cutting increases the eventual cost, thus averaging up for annual periods.

Second, competition and independent management produce great wastes in effecting sales. A union of competing firms saves these expenses and enables goods to be sold at lower prices, enlarging consumption. Many large commission houses that have the selling accounts of two mills manufacturing the same lines of fabrics, departmentize each account, which means a duplication of selling methods and expenses thus creating a waste of 50 per cent. Lawrence & Co. of Boston and New York had a separate account and department for Pacific Mills and Cocheco Mills until the Pacific Mills absorbed the latter plant and eliminated this waste. It is a well-known theory and an established condition that competition does not mean lower prices, because the wastes incurred under it oblige prices to be kept at a higher level.

Furthermore, competition between large enterprises often becomes commercial warfare. Competing firms sell goods for less than cost of production in order to crush out competition and to extend their markets. In the end smaller units are forced into bankruptcy and the remaining solvent companies combine forces in order to prevent ruinous competition in the future. Why should the York Co. of Saco, Maine and the Everett Mills of Lawrence, Mass., which are controlled and owned by identically the same interests, making the same line of fabrics and having their goods handled by the same selling house, be independent corporations with a duplication of every department from the manufacturing and selling to the executive? Why should the Parkhill Mills of Fitchburg and the Lancaster Mills of Clinton, Mass., compete in the gingham market and have a duplication of every department when both mills are under the same management? Such wastes as here illustrated must be abolished before the textile industry is established on modern, economic methods of doing business.

It must be admitted that the day of production on a small scale is past. Experience has proven that large scale production leads to more economical production and secures greater efficiency of plant. Would the 15 different mills of B. B. & R. Knight of Rhode Island be as conspicuously prosperous if operated under separate and independent management? The partnership of B. B. & R. Knight controls and operates 13,000 looms and 500,000 spindles from one office and one board of managers. This great concern with its print works and bleachery is an ideal textile combination. Above the actual manufacturing departments there is not a waste created by duplicating departments. It represents an ideal economic unit.

Third, the opportunities for "community of interests," combinations, and consolidations in the textile industry are limitless. With more than one thousand cotton manufacturing plants in this country the promoter and the financier have an inexhaustible field. It should be remembered, however, that the successful combinations have been those that endeavored to effect savings in producing and marketing their products and to sell at prices that offer less inducement for attacks by outside capital. The Standard Oil Co. has succeeded in reducing the cost of oil from $1.00 per gallon to one-tenth of that price. The American Sugar Refining Co. has reduced the selling price of sugar very materially. The milling interests in the West have reduced the cost of flour from $12.00 per barrel to one-half that price. The cotton industry is a tremendous opportunity. It is on the threshold of the greatest economic development in the history of the country, and if the industry is inoculated with the virus of modern corporate management, within twenty-five years we shall be manufacturing the greater portion of our entire production of raw material, and be supplying the world's markets with finished products. Just so long as we export raw cotton there will be opportunities for more cotton mills.

NATIONAL ASSOCIATION OF COTTON MANUFACTURERS.

As previously announced, the 88th meeting of the National Association of Cotton Manufacturers will be held on Wednesday and Thursday, April 27th and 28th, at Mechanics Fair Building, Boston, Mass. The Textile Exhibitors' Association, which extended the use of the building to the National Association, will hold its exhibition of textile machinery and accessories at the same place during that week. A tentative program of the papers to be read before the Association is as follows: Address by President Chas. M. Plunkett; "Welcome to the Commonwealth," by Governor Draper; address by President McLaurin, of the Massachusetts Institute of Technology; Report of the Committee of Standard Specifications for Gray Goods; Aboriginal Cotton Fabrics; Buying and Handling of Steam Coals; Certain Aspects of the Export Trade; Choice of Power for Textile Mills; Distribution of Light in Textile Mills; Electric Drive as a Manufacturing Proposition; Federal Corporation Tax Law; General Dyestuff Production Increasing; Methods and Progress of the Diesel Engine; Sizing and Finishing of Textiles; Superheated Steam and Superheaters; and Recent Developments in Cotton Dyestuffs.

It is possible that additions and changes will be made to the foregoing, but the different papers show a wide range of subjects of vital importance to textile manufacturers. The officers of the Textile Exhibitors' Association are busily engaged in arranging for the coming exhibition, which always proves of great interest and importance to the textile manufacturers. Practically all of the standard textile machinery and accessory concerns will be represented with exhibits, together with all of the latest improved machinery recently placed on the market. A partial list of the exhibitors is as follows:

Adams, J. Q. Co., Boston; Allis-Chalmers Co., Boston; American Cotton Teazer Gin Co., New York; American Finishing Co., Boston; American Mason Safety Tread Co., Boston; American Moistening Co., Boston; American No Slip Cement Co., Boston; American Steam Gauge & Valve Mfg. Co., Boston; American Textile Appliance Co., Boston; American Warp Drawing Co., Boston; Atlas Portland Cement Co., Boston; Barber, Coleman Co., Boston; Barnes-L. E. Broadway, Methuen, Mass.; Borne, Scrymser & Co., Boston; Bowser, S. F. & Co., Fort Wayne, Ind.; Bragdon, J. H. & Co., Boston; Butterworth, H. W. & Sons Co., Phila., Pa.; Carbolineum Wood Pres. Co., New York; Carrier Air Conditioning Co., New York; Cell Drier Machine Co., Boston; Cling Surface Co., Buffalo, N. Y.; Cluett, Peabody & Co., Troy, N. Y.; Coldwell Giddard Co., Fall River, Mass.; Concrete Bureau, Boston; Cooper-Hewitt Electric Co., Boston; Corrugated Bar Co., St. Louis, Mo.; Cotton Publishing Co., Atlanta; Craig Co., The David, Boston; Cramer, Stuart W., Charlotte, N. C.; Crocker-Wheeler Co., Boston; Crompton & Knowles, Worcester, Mass.; Dodge Mfg. Co., Boston; Draper Co., Hopedale, Mass.; Enterprise Rubber Co., Boston; Fiber & Fabric, Boston; Firth, Wm., Boston; Fries, W. John, New York; Gantt Piling Machine Co., Boston; General Vehicle Co., Boston; Harriman Engine Co., Boston; Heine Safety Boiler Co., Boston; Hetherington, John A. Sons, Boston; Holophane Co., Boston; Hussa, Theo. F., New York; Hydraulic Oil Storage Co., Boston; International Correspondence School, Boston; Jenkins Bros., Boston; Keystone Lubricating Co., Boston; Kilburn-Lincoln Co., Fall River, Mass.; Lambeth Rope Corp., New Bedford, Mass.; Lestershire Spool & Mfg. Co., Lestershire, N. Y.; Leyland Co., Thos., Boston; Link Belt Co., Boston; Lord & Nagle, Congress St., Boston; Macrodi Fiber Co., Woonsocket, R. I.; National Brake & Clutch Co., Boston; N. E. Cement Stone Co., Boston; Parks Co., The G. M., Fitchburg, Mass.; Penn. Cement Co., Boston; Penn. Metal Ceiling Roofing, Boston; Potter & Johnson, Pawtucket, R. I.; Root & Co., C. J., Bristol, Conn.; Sanitary Cement Co., Everett, Mass.; Sargent's Sons' Corp., C. G., Graniteville, Mass.; Sellers Co., Wm., Phila., Pa.; Stafford Co., The, Readville, Mass.; Structural Cement Stone Co., West Lynn, Mass.; Sub-Target Gun Co., Boston; Textile American, Boston; Textile Machinery Co., Boston; Universal Winding Co., Boston; U. S. Column Co., Cambridge, Mass.; Wadsworth Howland Co., Boston; Warren Bros. Co., Boston; Wert, C. S., Kendalville, Ind.; West Disinfecting Co., North Boston; Woonsocket Machine & Press Co., Woonsocket, R. I.

AMERICAN COTTON MANUFACTURERS' ASSOCIATION.

The following notice, signed by Secretary C. B. Bryant, has been sent out to the members of the American Cotton Manufacturers' Association:

"The Fourteenth Annual Convention of this Association will be held in Charlotte, N. C., May 17th and 18th, 1910, at which time many topics of importance to cotton manufacturers will be presented for discussion, among which the most important will doubtless be the report of the Committee on Uniform Sales Contracts. Arrangements are being made with railroads operating in all the Atlantic States to grant reduced rates on account of this occasion. An announcement will be made as to the details of these rates in the near future.

"The local committee has arranged for reasonable hotel rates and ample accommodations, as will be seen by the sheet attached. Suggestion is made that members write direct to the hotel management, engaging such accommodations as they wish. Forecast of program will be mailed in a few days, together with other detailed data regarding the Convention. Charlotte expresses much pleasure in entertaining the Convention this year, and we trust a very large attendance may be had."

The following hotel rates and accommodations will prevail during meeting of the Association at Charlotte, N. C., May 16-19, 1910:

SELWYN HOTEL: Corner West Trade and Church Streets. (American plan during this meeting). 150 rooms. 75 baths. $3.50 and $4.00 per day, without bath; $4.00 to $5.00 per day, with baths. Rates the same if more than one person occupies a double room. Cafe at regular rates will be open during the meeting for special meals or special service, but no rates for rooms on European plan will be made.

BUFORD HOTEL: Corner South Tryon and Fourth Streets. (American plan). 100 rooms. 10 baths. $2.50 and $3.00 per day, without bath. $3.50 per day with bath. Rates the same if more than one person occupies a double room.

CENTRAL HOTEL: Corner Trade and Tryon Streets. (American plan). 116 rooms. 14 baths. $2.50 per day, without bath. $3.00 per day with bath. Rates the same if more than one person occupies a double room.

STONEWALL HOTEL: Near Southern Railway Station. (European plan). 115 rooms. 85 baths. $1.00 per day for one person in room without bath. $1.50 per day for two persons in room without bath. $1.50 per day for one person in room with bath. $2.00 per day for two persons in room with bath.

GEM HOTEL: 15-19 South Tryon Street. (European plan). 24 rooms. 6 baths. Rates same as Stonewall Hotel.

Regular cafe rates will be maintained at the Gem and Stonewall during the meeting.

SPINNING FRAME IMPROVEMENT.

Doffing attachments to spinning frames have only recently been placed on the market. It may therefore be of interest to spinners in the United States to know that Norman R. Newsholme, of Keighley, Yorkshire, England, has recently taken out British patents and is now applying for a United States patent covering certain improvements in doffing mechanism for spinning frames.

This mechanism is fully automatic. The doffing motions (driven by belt) take the full bobbins off of the spindles and replace them with empty ones, leaving the frame ready for spinning immediately on completion of the doffing operation. The only work the spinner has to do is to pull the lever which sets these various doffing motions into operation. As this motion is driven positively by belt, the time taken for doffing can be permanently set, thirty seconds being more than sufficient. Besides being fully automatic and comparatively simple, this mechanism, by the novel employment of a more direct method, reduces the cost considerably.

THE ART OF KNITTING.

(*Contributed exclusively to* COTTON.)

BY FRED. W. SIMONS, PRESIDENT NATIONAL ASSOCIATION OF HOSIERY AND UNDERWEAR MANUFACTURERS.

Although the art of knitting is the most recent development of any of the branches of the textile industry, yet its rapid development has been an important factor in creating such a wide demand for the many garments and other articles of apparel that have become necessary in this advanced age. During the last fifty years inventive genius has continually improved and elaborated knitting machines, which seem to have no limit to which they may be improved and changed to produce new fabrics. The evolution of knitting machines from the first type can be better comprehended when it is stated that fully 5,000 different articles are now made in the knitting trade.

It may be said that weaving as practiced by some of the ancients was more or less of a similar operation to knitting, but the first allusion made to the operation of knitting as such dates to the fifteenth century. Very little information relative to its incipiency has come down to us, but it is generally believed that the art was first practiced in Scotland in a more or less crude manner, and afterwards carried to England. The making of caps preceded that of stockings, which is borne out by the fact that in 1488, in the reign of Henry VII of England, "knitted woolen caps" were mentioned in an act of Parliament.

No mention of stockings was made to show that the art had developed to that extent until 1553, when in an act of Edward VI, there were mentioned "knitte hose, knitte peticoats, knitte gloves, and knitte slieves." The hosiery industry continued to expand, and achieved prominence as a factor in the industrial efforts of the people, and in 1563 the trade of hosiers was included in an act of Parliament. It is recorded that Edward VI and Henry VIII were provided with Spanish silk stockings, which would indicate the rapid growth of that industry. In 1589 the hosiery industry received a tremendous impetus from the Rev. William Lee, of Woodborough, near Nottingham, England, who invented a stocking frame for producing the loop stitch. So perfect in principle was this invention that the essential features of this original machine are still in use to-day. Only a flat straight web was produced at first on the frame, but further familiarity with its possibilities enabled the work to be shaped by removing loops from the needles from time to time from the outer edges of the fabrics for narrowing, and bringing additional needles into operation for widening the goods. Like many other men of genius whose works have been of untold benefit to the human race, Lee received practically no pecuniary benefit from his invention. However, the stocking frame became a practical machine and a new industry was created.

The stocking frame invented by Lee consisted of a pair of wooden legs supporting a horizontal board which held hooked wires driven into the board next to each other, with the ends of the hooks turned upwardly, the wires being in a horizontal position. The hooked wires were very similar in design to the present day spring needle. The hooks were actuated to perform the operation of knitting by means of a beveled piece which pressed against the ends of the boards to close the hooks, and allow the stitches to be cast off.

The next important improvement to the stocking frame was made by Jedediah Strutt, of Derbyshire, England, in 1758, which consisted in adding another set of needles to the frame, for the production of ribbed work. The needles were placed vertically, that is, at right angles to Lee's needles, for working in combination with the horizontal set to produce the regular rib stitch. This added set of needles was arranged to be used or not, according to the requirements of the fabric to be knit. This invention proved of great importance to the industry and "Derby Ribs" became famous all over England. A patent on the invention was secured by Strutt and Woollett, the latter being a hosier who aided Strutt in perfecting the device. The invention of this new machine marked the beginning of a great business in this work and made Derbyshire a knitting center of importance. Only flat work was produced on this frame and no other system was invented until the nineteenth century.

In 1816 the first circular knitting machine for producing a seamless fabric was invented by Sir Marc. I. Brunel, Nottingham, England. This was a spring needle machine, with the needles secured in a vertical position in the rim of a rotating cylinder. The machine was named the "Tricotter" by the inventor. The machine was a very practical invention, being designed to have arms and wheels located around the circumference of the needles for actuating the same in the production of the fabric. Different diameters of cylinders were made, and several feeds were used with the corresponding arm and wheels for actuating the needles. Continuous revolution of the needle cylinder in connection with the several actuating wheels, resulted in a large production from the machine. It seems a singular fact that this machine was not exploited until 1845, when an improved type was brought out by Peter Claussen, who claimed it as his original machine.

The latch needle was invented in 1858 by M. Townsend, the needle of to-day being little changed from the original invention. Within the last fifty years the most marked progress has been made in inventing and perfecting knitting machines, so that to-day the great number of different types have been brought to a state of perfection that combines simplicity and durability of construction with maximum production. The industry in England in the early sixties was of a domestic nature, as at that time the machines were hired by the operatives, who worked for their own account. The custom of establishing knitting mills gradually combined these different units and in 1879 there were 186 knitting mills in Great Britain. The chief knitting centers in England at present are Nottingham, Leicestershire, and Derbyshire. Chemnitz, Saxony, is a celebrated knitting center and the product is largely exported. In the United States the knitting industry has flourished most in New York State, Massachusetts, New Hampshire, Rhode Island, Vermont, Connecticut, Pennsylvania and Maine. The establishment of knitting mills in the South during the past few years has been a feature in the rapid development of that section, and has served to demonstrate the possibilities of the future.

About 20,000,000 yards of cotton duck are made into overcoats with blanket lining, to take the place of heavy wool and fur garments in the American and Canadian northwest.

DEFECTS IN THE USUAL METHODS OF SECURING DEFERRED PAYMENTS IN SALES OF PERMANENT MACHINERY.

(Contributed exclusively to COTTON.)

BY HENRY A. ALEXANDER.*

The methods commonly employed by dealers in machinery of securing the deferred payments on credit sales are chattel mortgages and reservations of title. Concerning these securities, the general impression prevails that, if payment be not made, the machinery can be removed by the seller from the building where installed, and that this right will ordinarily operate to secure payment either from the debtor or, in case of insolvency, from mortgage bondholders and other creditors who may wish to reorganize. When he has duly recorded his papers, the dealer feels secure. It is his idea that his right to retake the machinery on failure to make payment can be effectually exercised, whether the machinery be movable in character or permanently attached to the building. And, furthermore, he feels himself secure even against the holder of a pre-existing mortgage on the plant, believing that if he can take out the machinery without causing substantial injury to the building and leaving the plant in the condition upon the faith of which the mortgage loan was made, he would have an unquestioned right so to do.

It will doubtless be a surprise to a great many of those who have these impressions to know that within the last fifteen years the law relating to chattel mortgages and reservations of title has been so construed by many of the highest courts of this country as to greatly impair the value of these securities, and to render it doubtful whether they really afford any protection. At present, throughout a large part of the United States, it has become an established rule of law that where property has been placed under a mortgage covering not only its status at the date of the mortgage, but all future additions and improvements—and at this time most mortgages contain such provisions—the subsequent vendor of permanent machinery which is attached as an integral part of the building, has no legal power, as against the holder of the pre-existing mortgage, to make an effectual contract retaining as security the title to his machinery, but that the same becomes immediately a part of the freehold, and, as such, subject to the prior mortgage, which is held to have a right to the machinery superior to that of the vendor. And this is true although the chattel mortgage or the contract reserving title was duly recorded in the manner and within the period prescribed by the statute. Difficult as it may be to realize it, this statement is nevertheless correct, and can be easily verified by referring to the case of *Evans v. Kister* in 92 *Federal Reporter* at page 836, decided in 1899, where no less a court than the United States Circuit Court of Appeals for the Sixth Circuit, Circuit Judges William H. Taft and Horace H. Lurton presiding, declared that:

"Upon the other hand, if the machinery so purchased and set up has become so affixed as to be a part of the principal thing, it will pass under the mortgage, notwithstanding an agreement between the mortgagor and furnisher that the title shall remain in the vendor until payment. Mere registration of an agreement between the mortgagor and vendor, preserving the personal character of property affixed to the freehold mortgaged, will not prevent the attached property from passing under a previously existing mortgage."

Coming from a court whose jurisdiction embraces the States of Kentucky, Michigan, Ohio and Tennessee, this decision, which has never been overruled or modified, is of first importance to those selling machinery in this territory.

The Circuit Court of Appeals for the Fifth Circuit has rendered a similar decision in 1901 in the case of *Guarantee Trust Company of New York v. Galveston City Railroad Co.*, 107 *Federal Reporter* 312. The eighth headnote is as follows:

"A mortgage of a street-railroad system covering after-acquired property creates a lien on engines thereafter furnished to the company in constructing a plant which was a part of its system, and is not to be displaced by a stipulation in the contract of sale that title should not pass till they were fully paid for."

Embracing within its jurisdiction the States of Florida, Georgia, Alabama, Mississippi, Louisiana and Texas, in which great quantities of machinery are being sold, this decision, which has never been reversed or modified, is of peculiar importance.

In the Fourth United States Circuit, including the States of Maryland, Virginia, West Virginia, North Carolina and South Carolina, the Circuit Court of Appeals in 1908 in the case of *Union Trust Co. v. Southern Saw Mills and Lumber Co.*, 166 *Federal Reporter* 193 approved and adopted the ruling of the case from the Sixth Circuit above quoted. These States also constitute a center in which a great milling industry is being rapidly developed, and the decision is of vital interest.

The importance of these decisions of the Federal courts lies in the fact that the machinery manufacturers of the country look to these courts rather than to the State courts to protect and enforce their rights, but it is true that the State courts are tending in the same direction. The Supreme Court of the United States, however, has never sanctioned this doctrine, as will appear from an examination of the cases of *Fosdick v. Schall*, 99 *United States Reports* 235, decided in 1878, and *York Manufacturing Co. v. Cassell*, 201 *United States Reports* 344, decided in 1906.

A curious feature of the situation is the fact that this doctrine originated with the Supreme Court of Massachusetts in the heart of the greatest machinery manufacturing district of the United States. A conspicuous follower of this court is the Supreme Court of Wisconsin in the case of *Fuller-Warren Co. v. Harter*, 110 *Wisconsin* 80. On the other side of the question and vigorously asserting the inequity of the rule is a court of the highest prestige, the Supreme Court of New Jersey in the case of *Campbell v. Roddy*, 47 *New Jersey Equity* 244, followed by the Supreme Court of Indiana in the case of *Brinkley v. Faulker*, 117 *Indiana* 176.

Under the present status of the law, the only way in which chattel mortgages and reservations of title can be effectively employed in the States where this inequitable rule prevails, is to obtain in advance of delivery the written consent of the mortgagee. On account of this, many machinery dealers have abandoned the use of these securities altogether and require the pledge of first mortgage bonds, or personal endorsements.

To make chattel mortgages and title reservations practical and effective, legislation is necessary providing that the

*Member of the Atlanta Bar, and Author of "Lien Laws of the Southeastern States."

doctrine of fixtures should not be construed to prevent their enforcement where the machinery can be removed without substantially injuring the building to which it has been attached, and that, as to vendors of machinery holding such securities, prior mortgagees are not innocent purchasers for value and can take no advantage of the formers' failure to record them. A decision by the Supreme Court of the United States declaring these principles to be the law would help greatly toward this end.

A FEDERAL COTTON EXPERIMENT STATION.

(Contributed exclusively to COTTON.)

BY J. N. INGRAM.

(Continued from January.)

AMERICAN COTTON PRODUCTION AND TRADE.

In 1908, 32,444,000 acres were planted in American cotton from which 13,563,942 bales, of 500 pounds, were produced. Statistics show that 1,830 American establishments manufactured cotton in 1907, operating 26,375,191 spindles that consumed 4,484,936 bales. Of these, 1,816 mills manufactured cotton exclusively. 202,733 bales used were foreign lint; 65,637,689 pounds Egyptian; 3,584,160 pounds Peruvian; and 962,073 pounds Indian. American cotton exports in that year, were 7,747,113 bales, of 500 pounds each.

Exports of American cotton goods in 1908 were 101,833,072 square yards of unbleached cloth, valued at $6,930,072; bleached, square yards, 23,896,769, valued at $1,529,057; colored, square yards, 80,244,971; valued at $5,809,019; waste, pounds, 54,784,473; valued at $2,631,595; thread and yarn; valued at $400,600. In the same year $3,843,810 tons of cotton seed were treated, making 175,724,840 gallons of oil, and 1,785,804 tons of meal and cake. Exported cotton products were: Cotton seed valued at $209,943; oil valued at $17,074,403, and cake and meal that brought $17,062,594.

Such vast interests call for national effort in their development and protection. The cotton departments at State experimental farms and agricultural schools are inadequate for the demands of the cotton industry; they are too feeble in capacity and limited in resource to accomplish the work desired and demanded. A great national cotton experiment station with ample appropriation for full equipment, managed by supervisors of adequate competence, provided with required facilities to bring cotton development up to its highest perfection, should be immediately established in the center of the cotton producing area, with sub-experiment stations located in surrounding cotton growing regions. The operations of the sub-stations would be governed by the central station. Under such direction and with such equipment the great problem of cotton development, seed selection, soil experiment, variety comparison, plant culture, fertilization and many other specialties involved in cotton production could be investigated and studied under the full light of modern knowledge and scientific research. The results garnered from such an agricultural laboratory could be submitted through monthly circular publications to cotton growers throughout the cotton producing States.

Soil exhaustion by excessive plant growth and fertilization cost, already call loudly for investigation and study; new composts and less expensive fertilizers may be found for cotton production and land improvement, the staple thereby grown with smaller expense and marketed with greater profits. Our earth elements may hold naturalized and unknown properties for soil fertilization and crop production. Marl may not be our only subterranean fertilizer. Our vegetable kingdom, through intelligent processes and chemical manipulations, may be made to yield an economical and valuable source of land rejuvination. Inventive talent, officially employed and properly encouraged, may devise improved and needed machinery for land cultivation, and cotton harvesting. Lint production would then be relieved of present drudgery, excessive toil and exorbitant expense. Such soil restorers, crop producers, cultivation aids and mechanical helps could be elaborated and perfected at a properly equipped National cotton experiment station. The age of the gin and factory consolidation may then come, and the wedding of the plow and the loom on Southern cotton fields follow. America will then continue to lead the world in lint production, control its cotton markets, supply its factories, and clothe its population.

The central Federal cotton experiment station for geographical reasons and agricultural advantages, could be located at Atlanta, Ga., in the midst of the cotton yielding territory. A sub-experiment station could be located at Natchez or Vicksburg, Miss., to take care of the Mississippi Valley—the heart of the cotton yielding world. Another sub-station could be operated in central Texas, and provide for that vast lint growing domain. Another might be placed in Florida to supply Gulf coast requirements. Another sub-station could be founded in Cabarrus County, North Carolina, and from its situation and commanding latitude develop the interests of the Piedmont cotton growing section. Such locations could cover the territory along their parallel through North Carolina, South Carolina, Tennessee, Georgia, Alabama, Mississippi and Arkansas, and advance cotton welfare from Pamlico Land to the Choctaw Nation.

Water-power hitherto flowing wastefully to the sea, and recent development of electric power plants, have made the Cabarrus region the center of Southern cotton manufacture. Many hills and river banks for one hundred miles around, are covered with factories; overhead cables communicate with adjacent villages; force is transmitted from electric stations to distant localities; old mills have enlarged, new ones have been erected; steam machinery discarded and electric power substituted. Ere long the Piedmont region will be a mammoth cotton manufacturing mart; its output of textile goods enlarged and lint consumption increased a thousand fold. Such a staple and such an industry as cotton production is worthy of national stimulation and protection. I have shown the want, need and value of a Federal cotton experiment station, with sub-stations.

How is such a benefit to be acquired and such a boon gained. It will have to be done by effort. That effort will have to be made by cotton producers. Such an undertaking will require money. The enterprise will be national in character and benefit; it is the nations duty to furnish the revenue needed. The cotton region is a part of the nation; it pays a fair proportion of the taxation for the other national works of development. The required government appropriation can be secured only through Con-

gress. It can be officially influenced by energetic and zealous members from the cotton growing region. The responsibility and effort, therefore, comes back to cotton producers. Accomplishment of such a work will require voters in cotton growing States to combine and send only delegates to Washington who are in sympathy with cotton producing interests, and pledged to work for a national appropriation for the establishment and operation of a "General Federal Cotton Experiment Station," and necessary sub-station, devoted to the exclusive interests of cotton. Then such an institution may be founded and cotton receive consideration and provision for its development and welfare that its importance demands and value requires.

Providence is said to help them who help themselves. Governments sometimes do likewise. Cotton's prosperity and fate rests on Southern ballots, which can direct the future.

FEDERAL AGRICULTURE EXPERIMENT STATION.

In 1887 an agricultural experiment station, as a national institution was established in the United States. Ohio, Massachusetts, Tennessee and New York had founded experiment stations five years previous. Sixty experiment stations are now operated in this country. Fifty-five stations receive funds from congressional appropriations. One experiment station in every territory and State in the Union received Federal money for maintainance. Louisiana, Alabama, Missouri, North Carolina, New Jersey, Connecticut and Hawaii sustain separate stations by State and private donations. Twenty-two States have demonstration farms.

The experiment station in Porto Rica, including a coffee sub-station, receives an annual United States appropriation of $15,000. One hundred scientific operators and executive officers form the working force at these stations. The stations have a yearly income of $2,334,671 and receive annual Federal appropriation of $1,056,000. State station donations are $770,000 yearly. The Federal experiment station department received in 1907, an additional appropriation of $254,860, including $122,200 for irrigation.

The four stations in Alaska, including fruit and vegetable sub-stations, receive a Federal appropriation of $18,000 yearly. The Sandwich Island Federal Station is given a United States appropriation of $20,000 annually. (Another Hawaiian sugar planters' station receives from their association $65,000 yearly). An experiment station is also operated on the island of Guam.

FOREIGN EXPERIMENT STATIONS.

Experiment stations abroad have also flourished. India has established eight stations in different provinces for agricultural experimentation. Two cotton stations are operated in the Madras department. A Japanese station in Korea has a yearly allowance of $85,000. An agricultural experiment is supported at Pekin, by the Chinese government. The Mexican republic sustains an agricultural experiment station in Pueblo State; and a coffee and rubber station in Chiapas. Italy has a cereal station at Rieti; and France operates a vegetable station at Grignon. Australia has a successful station, and Ceylon owns two agricultural experiments. Germany is at present expending $150,000 yearly on fifteen agricultural stations, honey production, bee study, milling research, grain storage, wheat and flour study. Africa reports three experiment stations, tobacco selection and breeding. The world is therefore moving along in the world of industrial investigation and agricultural experiment. American cotton production may yet receive deserved attention.

COST OF STEAM VS. ELECTRIC POWER.

EDITOR COTTONS I have read with a great deal of interest the article on "Cost per Horse-Power of Steam and Electric Drive" in the March issue, and if this subject is open to discussion, would like to say a few words along this line. Basing my ideas upon a careful perusal of the article in question, I would suppose that in the case of electric drive the intention is to purchase current from an outside source, as there is no mention made of generators in the cost for electric drive. In this case I can not see how any comparison can be made between the two systems. On the one hand we have a complete power plant ready to furnish power to the mill shafting, and on the other hand we have the motors only. Before the wheels can turn they must be supplied with energy from some source of supply. To place the two systems on an equal basis of comparison, that is, to give the relative cost of rope or belt transmission versus electric transmission, we must assume that the source of power be supplied from a common point; and upon this assumption in the case of direct drive we would only need the sheaves and ropes to convey the power to head shafts. Sixty 1¾-inch ropes would transmit this amount of power and would cost including installation $1,800. Three 74-inch sheaves aggregating 60 grooves would cost $1,000; pillow blocks and head shafts $700; and erecting same $300. This would give us a total of $3,800 or $1.52 per horse-power.

For the motor drive we would need not less than 3,000 horse-power (as we must provide for temporary overloads.) This at $12 per horse-power installed ready to run would amount to $36,000. We can take the interest on the investment in both cases at 5 per cent., which, on $3,800 will amount to $198 and on $36,000 will amount to $1,800 per annum. Depreciation will be charged off on both at 10 per cent., making $380 and $3,600 per annum respectively, or a total of $578 for the direct and $5,400 for the electric drive, or 23 cents per horse-power per year for direct, and $2.16 per horse-power per year for the electric. From this data we can readily see that the power furnished the electric drive must cost $1.93 per horse-power year less than the same power furnished to the electric drive, making a total of $4,825 in favor of direct drive based on equal power cost.

The writer was connected with a mill at Columbia, S. C., in 1894 and 1895, that was the first exclusively electric driven mill in this country. This mill, as is well known to most textile manufacturers, was the most costly mill built at that time, its cost being in the neighborhood of $26 per spindle as against $13 to $14 of the average mills. The most of this increase was due to the extra cost of electric transmission. The writer has had in his charge for the past seven years a steam plant using a cross-compound condensing engine developing an average of 1,400 horse-power, and the average yearly cost is $8.20 per horse-power year. This of course, does not include interest and depreciation, but does include every other item of cost; that is, coal, labor, oil, packing and repairs. Charging off interest and depreciation at 5 per cent. and 10 per cent. respectively on a cost of $35,000 for the power plant, we have

$5,250, or $3.71 per horse-power year, making a total of $11.91 per horse-power per year for steam power.

Although the writer is a firm believer in electric transmission of power, yet there are cases where instead of being a benefit it is a source of much loss and trouble. On the other hand when used under suitable and favorable conditions the results are very gratifying. One case will be cited that may prove of interest in this connection. The writer took charge some years ago of the mechanical end of a textile mill that pumped all water used both for power and domestic purposes from a river situated one mile from the mill into a reservoir one-half mile beyond the mill, making a total length of discharge pipe of 1½ miles against a head of 240 feet. They used for this duty a 10, 16 and 10 x 16 compound simplex pump running at 90 strokes per minute, the boiler and pump being located on the river bank.

The cost of this plant, exclusive of piping, was $3,300 and the average yearly cost of coal, labor, oil and maintenance would equal $1,177. In 1904, an electrically-driven centrifugal pump was installed, the motive power being a 75-kilowatt, 500-volt generator belt-driven, and a 75-horse-power motor with rope drive to pump, the location of the pump not permitting a direct connection to the motor. This plant cost $5,000 installed complete and was operated from the engine room at the mill, a man going down about three times per week to look things over, trim the brush and oil the machines. The average running time of the pump was 40 hours per week, pumping 30,000 gallons per hour and the average yearly cost was $425. Now taking the interest and depreciation on the investment of $3,300, equals $1,672, the yearly cost of the direct-driven steam pump.

The interest and depreciation on the investment of 5,000 equals $1,175 as the yearly cost of the electric-driven pump, or a yearly saving of $497. Most of this saving is due to the elimination of labor required on steam pump, the balance to the superior economy of the generating unit being driven by a compound engine as against a steam-driven pump.

As to the convenience of the electric drive, there can be no question. As to the economy, there is no denying the fact that it is far more costly than the rope drive. Given a water or steam power plant of any magnitude the cost of rope drive will rarely cost more than $1.00 per horse-power, whereas, if generators and motors are used it will increase the cost of a power plant from 80 per cent. to 100 per cent., and the interest and depreciation on this increased investment will add to the power cost in like proportion. There is little or no saving in shafting and belting in the group drive, and for textile work the individual drive is a luxury not to be thought of—Richard Thirsk.

More than fifty separate laws were passed by the legislatures of various States within the past two years regulating the conditions of employment in factories and mercantile establishments and making provision for inspection. Under the South Carolina law two inspectors examine provisions for safety and sanitation and make investigations as to the employment of women and children.

According to J. M. Lange, a cotton grower of Mobile, Ala., the boll weevil is expected to reach the plantations of Alabama before 1912.

ESTIMATING THE VALUE OF A WATER-POWER.

BY CHARLES T. MAIN.

A water-power may be of more value for one kind of business than another, and its value is very largely determined by its location.

The value of a water-power depends upon the quantity of water, the fall, and the uniformity of flow during the year and for a succession of years. This is an axiom, and we should be obliged to go no further than this to dispose of the method of estimating values as stated at the outset. The effect of the fall is to increase or decrease the cost of construction per horse-power. If the fall is low, the cost per horse-power of a plant will be very much more than that for a high head. The value of that power of low head can not be as great as that for the high head, other things being equal, because the first cost of the plant and the fixed expenses, such as interest, depreciation, repairs, taxation, and insurance, will be greater for the lower head per horse-power; so also will be the running expenses. To get the same return for the money expended, more money is required in the construction of the plant with a low head, and less value can be placed on the power itself.

The effect of variable flow upon the value is more difficult to estimate, and also to determine at what point of variability the power becomes of no value. Other things being equal, the value of a water-power depends very largely upon its location.

If the value of the water-power varied directly as the cost of fuel, then the farther away from a railroad the power is located, and the more it costs to haul coal to it, the more valuable would be the power. If there is raw material to be brought to the mill and finished product to be taken away, it is a self-evident fact that the nearer the railroad or seaport the mill can be located, the more valuable the power which drives it. This reasoning can be carried to an absurd conclusion by saying that a water-power is more valuable in the wilds of Maine, where there is no railroad and consequently where fuel is expensive, than in Lawrence, Lowell, or Manchester.

The value depends largely upon the fact whether or not the social conditions are or can be made such as to cause good operatives to locate and remain in the place; upon the sanitary conditions; and sometimes even, in the case of a developed power, upon the management of municipal or town government. All of this can not be estimated in dollars and cents, but determines to a certain extent the profits or losses.

There is in almost every business need for steam for other purposes than power, if for no other purpose, in colder climates, than for warming the buildings in cold weather. This steam can usually be used after being exhausted from an engine, requiring the consumption of little or no more fuel than is required to produce steam for the engine alone. The plant required for producing the steam is a necessity when water is used for power, and should be included in the cost of power-plant, and the expense of running included in the cost of producing power. This item may be so large as to make a positive loss by running the boiler plant for steam for heating and using water for power, over and above the cost of producing the power by a steam plant and using the exhaust steam for heating purposes.

The Textile Mill Situation in the South and New England.

NEW ENGLAND MILL SITUATION.

(*Special Correspondence*)

An undertone of intense conservatism has developed during the past six weeks in the textile industry in New England because of the many unfavorable features of the cotton goods and raw cotton market. As a result of this feeling there is general curtailment whenever goods can not be marketed at a reasonable profit to the manufacturer. Very few contracts for plain goods for future deliveries are being placed. Spring trade has stimulated certain lines of fancy goods and the finer counts of white fabrics, while Western retailers are having the best trade for lightweight fabrics in several years.

The primary reason for curtailment in New England is that very unsatisfactory prices are being quoted for fabrics. Manufacturers do not feel justified in accumulating a stock because of the probability of lower prices for raw cotton as soon as the new crop is planted. During the famous Sully boom a number of New England mills were forced to dispose of their stocks of fabrics at a net loss of over 30 per cent., because they had purchased raw cotton in the early winter months, and although they did not have contracts or orders for fabrics they maintained full operation and consequently accumulated a large quantity of goods made from high-priced cotton. Manufacturers are therefore exceedingly cautious now.

There is a general fear that there will be an attempt at a corner in May cotton. The writer has talked with numerous cotton brokers in the South recently, and it seems to be the consensus of opinion that the fabric market will show a gradual improvement as spring opens, and that mills will be forced into the cotton market during the latter part of April, which will give the necessary fillip to the bull movement in May cotton. One gentlemen stated that the only thing operating against a May movement was the large quantity of spot cotton that has been used as a hedge against the sale of May options. Opinion, however, is pretty evenly divided and one man's guess is as good as another.

There has been a general movement throughout the country to curtail. Southern and Northern mills have seen the wisdom of a curtailment schedule of from 10 to 40 per cent., and it is conservatively estimated that during the month of March the aggregate curtailment in this country was very close to 33⅓ per cent.

Philadelphia textile mills have been forced into idleness because of the labor disturbances in that city. The hosiery mills have felt the idleness keenly, because the hosiery market had shown a radical improvement just previous to the strike, and indications were for a good spring business. Many mills have sold their spot cotton amounting into quite large figures and have become resigned to a long drawn out battle between the labor element and the Rapid Transit interests. Yarn mills in that city were perfectly willing to close down, because they have been accumulating yarns for some months past and although manufactured from high-priced cotton there is a feeling that the net loss for the year will be less if they do not operate their plants until there is a general improvement in the industry.

The uncertain conditions of the industry act as an exceedingly reliable damper on labor disturbances. Ever since the 56-hour law went into affect in Massachusetts last January there has been a feeling of unrest among the labor organization, and if business had been prosperous there would have been demands by many large labor unions in the New England States for increased wages. With the greatly increased cost of living, labor has become very uneasy; and just as soon as the textile industry regains its poise there will be labor troubles in plenty.

The yarn market holds fairly steady although spinners are suspicious that there is price-cutting to create sales. Weaving yarns have quieted down and are selling slightly lower than last month, because of the curtailment program of weaving mills. Hosiery yarns would have shown a satisfactory improvement this month if the Philadelphia mills had not closed down and sold a portion of their stock of yarns in anticipation of a long strife in that city. The Southern spinners combination has proven unsatisfactory, it is stated.

Export trade has been limited to about 10,000 bales of sheetings and three shipments of 3,000 bales each of drills that went to South America. Brazil has taken several consignments of tickings. The Red Sea trade is quiet with a few inquiries for prints. Manila trade has been very satisfactory and judging from present inquiries there will be quite a large business with Manila merchants this spring.

The most unpleasant development of the month was the passing of the semi-annual dividend of 3 per cent. on the preferred stock of the Consolidated Cotton Duck Co. because of the very poor earnings for the past six months. Earnings were less than one-third of the previous six months' showing.

Textile machinery manufacturers are running full time on contracts placed last year for new mill equipment; but actual orders received would hardly justify much more than half-time schedule. Looms are being shipped to every State in the East and South where there is cotton manufacturing, by the Draper Co. and Crompton & Knowles Loom Works. Both of these companies are working full time and are being pressed for deliveries that are somewhat over due. Spinning machinery is less active, and yet there are a number of new orders being placed by Southern mills for new spinning frames to take the place of older types that can not be profitably operated. The Stafford Co. is reporting its share of new business. Saco & Pettee Machine Works report a fair volume of new business. Mill supply houses in the South are well stocked with goods, and although they are not having as large a business this month as during March, they appear to be well satisfied with existing conditions. In point of sales and profits, 1909 was the biggest year for supply houses in the history of their business. New mill equipment is profitable.

Textile mill shares continue strong in every market. Southern issues have braced up considerably since the first of the year, and a large part of the buying has been by Northern investors who believe that New England mill

shares are higher than conditions of the industry warrant. They have investigated the industry sufficiently to know that there is a splendid record back of the seasoned Southern mill stocks, and they are purchasing such issues quite liberally. The manager of a large fund advised the writer that it was easier to get safe stocks of Southern cotton mills to net 6 per cent. than New England mill stocks to net 4 per cent., and consequently he was placing considerable money in the better paying issues. Fall River shares are so strongly held that there is hardly a fraction of a point change when sales are made, even if the mill is known to be operating at little or no profit. New Bedford issues are held by such estates as the Ames estate of Boston, and large blocks were owned by Henry M. Rogers and have appeared in the inventory of his estate recently filed. A New Bedford mill treasurer stated to the writer that five of the larger banking houses in New York city were recorded as holders of substantial blocks of the shares of his mill. This is just one of the many straws that show the next evolutionary step of the textile industry.

SOUTHERN MILL SITUATION.

(*Special Correspondence.*)

A report recently appeared in a well known textile journal estimating present curtailment among Southern mills to be over 50 per cent. The concensus of opinion of well posted manufacturers who have visited and studied the general situation all over the South is that the figures are greatly exaggerated, and therefore do injury. When mills get the idea that curtailment is heavy there is a tendency to "let the other fellow do the work." Unfortunately when a mill shuts down for a day or so to make repairs, or for some other trivial cause, reports have been sent out that it was curtailing. The result is that the idea has gained wide credence that most of the Southern mills are curtailing. This is not the fact, and has not been. It is true that curtailment just now is the heaviest in many years, perhaps in the history of cotton milling in the South, but it is by no means 50 or 60 per cent. There is, in all likelihood, more curtailment in effect just now in North Carolina than in any other Southern State. The journal referred to above, estimates curtailment in North Carolina to be 49.9 per cent. A high official of the North Carolina Cotton Manufacturers' Association was asked about the correctness of this estimate. In his opinion, instead of 50 per cent., curtailment among North Carolina mills at present amounts to only about from 15 to 25 per cent.

T. W. Crews, Secretary of the Southern Hard Yarn Spinners' Association, thinks curtailment in North Carolina and other Southern States may be conservatively estimated at 25 per cent., the majority of this being among yarn mills. He states that a statistical report is impossible, as mills have not reported to him the amount of curtailment. His ideas are based on information constantly picked up from various sections, partial reports, and general observation. Asked if it is true, as reported, that mill men are shortly to convene to take definite action on the curtailment proposition, he stated he knows nothing of such plans, and that such a meeting is not necessary, as mills are curtailing at present as much as they are able. He knows of no great accumulation of stocks, and thinks recent indications are rather encouraging, considerable business having been put through in yarns.

As an instance of the discrepancy of the figures quoted by the magazine referred to, Virginia is cited as having 60 per cent. of spindles idle, whereas, as a matter of fact, the Dan River Mfg. Co., at Danville, which represents fully 60 per cent. of Virginia's spindleage, is running full time. In North Carolina, where curtailment is heaviest, there are many small mills, and it is among these that curtailment is being carried on to the greatest extent. Large mills, as a general rule, are not curtailing to any great degree. A former official of the American Cotton Manufacturers' Association, and the head of a number of cloth mills, estimates Southern curtailment at 25 per cent. Neither does he know of any great accumulation of export goods, as reported. The export mills which were reported to have had heavy accumulations two years ago, moved these goods last year, and at present there is very little stock on hand.

The trouble has been in the past that curtailment among mill men was somewhat like reduction of acreage with farmers, each one looked to the other to make the reduction. When exaggerated reports are sent out that curtailment is heavy, there is a tendency with the individual to let up, thus rendering concerted and adequate curtailment impossible. It is true that in curtailment lies the only remedy. Nor is it a matter of choice so much as of necessity with many mill men; but exaggerated reports will only retard the work. If further curtailment is deemed advisable it is well enough to figure on the true status. Several large deals in yarns have recently been made. Stocks were disposed of at low figures, it is true, but the fact that business has been put through on a large scale is encouraging. While there is some accumulation of yarns, stocks on hand are not large, as compared with the situation some time ago.

Charlotte is making extensive preparations for the entertainment of the many delegates who will attend the convention of the American Cotton Manufacturers' Association in May. Action on the proposed sales note contract and other vital issues before mill men will contribute to making this meeting of unusual importance.

Despite the depression prevailing in cotton goods and yarn markets, new mills continue to be organized, and the record of this year in new mill construction work and improvement is by no means under that made last year, which was a record breaker.

EGYPTIAN COTTON IN ARIZONA.

The soil and climate of Arizona are adaptable to successful growing of Egyptian cotton, according to the announcement of the bureau of Indian affairs of the accomplishment of its experimental station at Sacaton, near Phœnix, Ariz. The work has been carried on for the past two years by the Indian bureau in conjunction with the bureau of plant industry. Several acres were planted and as the result of raising two crops there is now in the hands of the superintendent of the station 9,000 pounds of fine long staple cotton, which will be shipped to the Indian bureau's warehouse in New York for marketing.

The bureau of plant industry has for a number of years been testing the possibilities of raising Egyptian cotton in the hot regions of the Southwest. These experiments, it was said at the Indian office, have proved that Egyptian cotton will thrive in that section of the country and that the length of the staple does not suffer as the result of transplantation to the new soil, climate and conditions.

MARKET REVIEWS.

MONTHLY REVIEW OF THE COTTON MARKET.

BY H. & B. BEER, NEW ORLEANS.

Conditions in the cotton market are likened to a paradox in so far as the United States is concerned. Of late there has been a good business put through in England for account of China and India, and, as a result, Manchester's trade advices have been favorable, cloths and yarns having been quoted firm and in good demand at full prices. In America the situation is just the reverse of conditions abroad. According to latest advices from New York, some of the standard makes of cotton goods have been cut one cent per yard in value in an effort to create a demand in order to reduce accumulated stocks. At the prices quoted it is said that these goods are cheaper than they have ever sold considering cost of production based on cotton. In this connection the citation is made that in 1898 a prominent line of bleached goods was priced at 5 cents, while raw cotton was selling at 5⅜ cents, but to-day Lonsdales are selling at 8¾ cents while the raw material is quoted at 15 cents. The recent reduction of the finished product, however, has served to revive the demand for goods, and it is probable that the trade will take advantage of the opportunity to secure supplies under the extraordinary inducements offered, as there is no telling what the future holds in store as regards the value of the raw material, so much depending upon the character of new crop accounts.

There was published on March 21 the final census report on last year's actual growth, the returns by States being as follows, linters included:

	1909	1908
Alabama	1,071,985	1,360,601
Arkansas	715,670	1,020,704
Florida	62,711	71,923
Georgia	1,897,761	2,026,999
Louisiana	268,800	481,979
Mississippi	1,106,170	1,668,461
North Carolina	647,747	701,356
Oklahoma	571,370	705,200
South Carolina	160,167	1,242,012
Tennessee	248,778	349,525
Texas	2,549,407	3,724,575
Other States	62,664	78,796
United States	10,363,240	13,432,131

The present high levels for raw cotton are due, as is now generally known, to last year's short crop, which was the result of drouthy weather conditions all of last year in the Southwest, attended by abnormally high temperatures that helped to cut down the yield west of the Mississippi River, Texas and Oklahoma alone having lost 1,304,000 bales compared with season before last, while the incessant rains in the Mississippi Valley and Alabama, reinforced by the weevil, reduced the yield in this section 1,064,000 bales, while unfavorable climatic conditions in the other sections of the belt cost the crop another 685,000 bales, the year's loss compared with the crop of 1908 having been 3,069,000 bales. The high levels prevailing for raw cotton all this season have caused spinners to buy only from hand to mouth, which policy has also been followed by jobbers, and in turn by the retailer. In consequence consumption has been reduced to the extent that the crop, short as it is, will be made to go around by means of the mills drawing on their reserves to the extent of about 2,000,000 bales, which would allow about 12,500,000 bales for this year's consumption against 13,157,000 bales of American last season, which would leave the world's visible and invisible supply at the end of this season at about 1,000,000 bales compared with 3,052,000 bales on hand at close of last season. As to the future course of the market, though there be efforts at manipulation, much will depend upon weather conditions and prospects for the new crop.

As regards preparations for the next crop, preliminary work is well advanced, the only drawback being claims of insufficient rain in Texas. East of the Mississippi River the outlook was never more promising, weather thus far having been ideal. The soil is in excellent condition to receive the seed, planting of which is now getting under way on an increased acreage. We do not consider the situation in Texas alarming at all as yet, for the reason that the rainfall in that State for the four months ending February 28 averaged a total of 7.64 inches compared with 4.38 inches last year for the same time and an 18-year average for the same period of 7.52 inches. Meanwhile, beneficial showers in some sections—good rains have fallen. As a matter of fact, corn is coming up to a good stand, as is cotton in some districts of extreme southwest Texas, which was not the case this time last year, when farmers in southwest Texas were waiting for rain to replant corn, owing to their inability to secure a good stand on corn; much less cotton. However, the whole State would be benefited by a general heavy rain, the need of which will probably be complained of more and more until such relief is had. Continued dry weather in Texas would probably influence prices to a higher level, but good, beneficial rains would in all likelihood cause prices to decline sharply, if only temporary, pending further crop developments, as there is no denying the fact that the world will require a very large crop next season, of at least 13,000,000 bales; and 14,000,000 bales could be taken care of without affecting the situation materially.

The following statistics were made up by the New Orleans Cotton Exchange at close of business March 18th:

	1909	1908	1907
Amount of crop marketed	8,878,100	11,656,189	9,648,295
Remaining to be marketed estimated	1,622,000	2,170,000	1,924,000
World's visible supply, American	2,927,607	4,012,076	3,242,366
World's visible supply, other kinds	1,343,000	1,204,000	1,259,676
World's visible supply, total	4,270,607	5,216,076	4,502,242
Price of middling cotton, New Orleans	14 13/16	9¼	10⅞

THE YARN MARKET.

An analysis of the operations in the yarn market during the past month would seem to indicate that yarn prices were scraping bottom, with the price of the raw material around 15 cents. Some of the yarn mills who had not stocked up in the early Fall on 10 cent cotton have had to make their plans accordingly and as a result curtailment on an individual basis was put into operation some five or six months back by these mills. Others who had provided their mills with cotton for some time ahead were loath to join in the curtailment plan as long as their mills could be operated with even a small or no profit, hoping that the situation would soon be straightened out and enable them to enter upon a period of healthful operation with their mill organizations unimpaired. But the long looked for amelioration in the market has not been realized and these mills have now reached the point where a plan of curtailment for them is the most natural course to pursue. It is this decision that justifies the belief that bottom prices have been passed, as the continued accumulation of yarn on the market that could be sold below the nominal quotations, has been one of the depressing factors and was one of the causes of continued irregularity. It is also a fact that the demand has been very meager, but with the supply cut off there is every hope for betterment in prices at least.

Very little business was put through during the month, and it seemed hardly worth while to even quote prices, as there was such a discrepancy in the views of the spinners and buyers regarding the prices at which they would do business. The situation became more acute every day, with the buyer in rather the more favorable position of the two. Demand for yarns was practically negligible, and especially was this true of hosiery yarns, and to a great extent for weaving yarns. About the only bright spot was the fairly good demand from the webbing and wire goods trade.

As stated last month, yarn mills that have been operating have accumulated more or less stock at the mill, rather than consign it, but in some quarters it is now believed that there is a willingness on the part of the mills to send their product to market and leave the question of price in the hands of the commission houses. Quotations and sales were on a lower basis than for some time, and some buyers took advantage of the general irregularity to circulate many reports of sales at prices below the market. However, buyers began to realize the position of the manufacturers and took cognizance of the curtailment in force. This fact was demonstrated by the increased number of inquiries received and the business that resulted in some instances.

The spinner has thus done his part in an effort to rectify conditions, and it seems that only a revival in the demand is needed to send prices to their proper level based on the price of cotton.

THE KNIT GOODS MARKET.

Conditions in the hosiery and underwear division of the market during the first part of last month were very dull, with prices maintained on all lines of cotton goods. Woolen hosiery enjoyed a fair business and the future prospects were quite favorable. Prices on cotton hosiery were held firm to the detriment of any activity, but manufacturers claimed that shading of prices was not warranted by the quotations of the basic markets. Very few orders were forthcoming that were expected at that season, and the belief is held that the supplies of jobbers is very low and will have to be replenished at an early date. It would be very natural for the buyers to come into the market at the same time and find that they were not able to fill their requirements as easily and satisfactorily as they would want. The commission men fully anticipate such a state.

The small duplicating business for spring was especially noted and seemed to indicate that original purchases were made in sufficient quantity and at satisfactory prices to obviate the necessity of further orders in those lines. Towards the middle of the month more interest was taken in the market, and a number of buyers appeared with orders, but of small proportions. It was a very encouraging sign and serves to indicate at least that buyers were in need of stock, even if they were then only doing a hand to mouth business in the market at that time. It is problematical as to when the real demand will set in, but the fact remains that such needs exist.

Many requests were received from buyers to have goods on contract shipped in advance of the regular dates, which may have two interpretations, namely, that stocks in their hands were very low and the goods were in urgent need, or that the buyers were not taking any chances of having the goods to fail to be delivered.

Towards the latter part of the month concessions were made in some lines of hosiery to induce business, the reduction ranging from 2½ to 5 cents on low and medium grades of standard cotton hosiery. Different reasons were given for the decline, one being the prospect of a large cotton crop. Moderate buying orders were forthcoming, but the demand was not as great as might have been expected. However, a great many orders were placed in sellers' hands at prices somewhat under the market.

IMPROVED HOSIERY.

Writing from Chemnitz, Consul Thomas H. Norton calls attention to some new features in Saxon hosiery knitting:

Of late years there has been dissatisfaction over the liability of hosiery, especially the finer grades, to tear where the ordinary hose supporters are hooked or attached. The complaints have increased as the old-fashioned garter has been steadily discarded for the more modern and hygienic supporter. Two new styles of Chemnitz hosiery have appeared, warranted free from the defect. In the first design an additional "garter welt" is knit about the top and forms a constituent part of the stocking, four inches below the customary welt. The additional cost per dozen pairs is 12 cents.

A second design presents two broad loops on opposite sides of a stocking, starting five inches below the top. They are one inch wide and one and one-half inches long, formed during the operation of knitting, and constitute an integral part of the stocking. Supporters can easily be attached to these loops, but the results of wear can not extend to the stocking proper. The addition costs 16⅔ cents per dozen pairs of hose.

A Philadelphia knitter recently introduced a so-called "garter-top half hose," so made that the upper, stiff, elastic part of a sock holds it firmly in place, and all additional support is unnecessary. The American invention is designed more particularly for men's socks, worn by wearers of knee-length drawers, while the Saxon novelties meet rather a need for ladies' hose.

COTTON MANUFACTURING

DESIGNING AND CLOTH ANALYSIS.

Rib Weaves, Plain and Fancy—Basket Weaves—Broken Twills.

(*Contributed exclusively to* Cotton.)

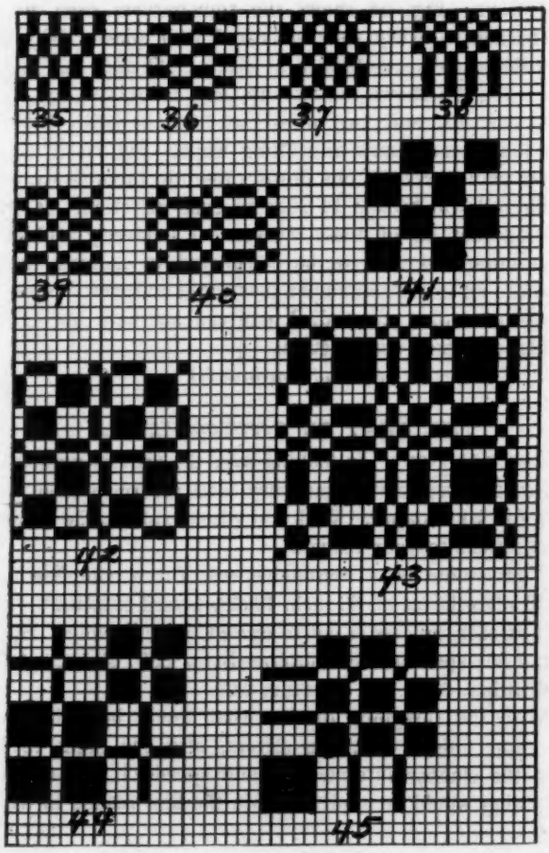
BY CHAS. E. BARNHARDT.

(*Continued from November, 1909.*)

PART III.

It was stated in the preceding section of this article that almost every weave will be found to be derived either from a plain weave, twill or satin foundation. The rib and basket weaves, which are derived from the plain weave, will now be explained.

The chief characteristic of a rib weave is the ribbed effect produced in the cloth. In a warp effect rib weave



Rib and Basket Weaves.

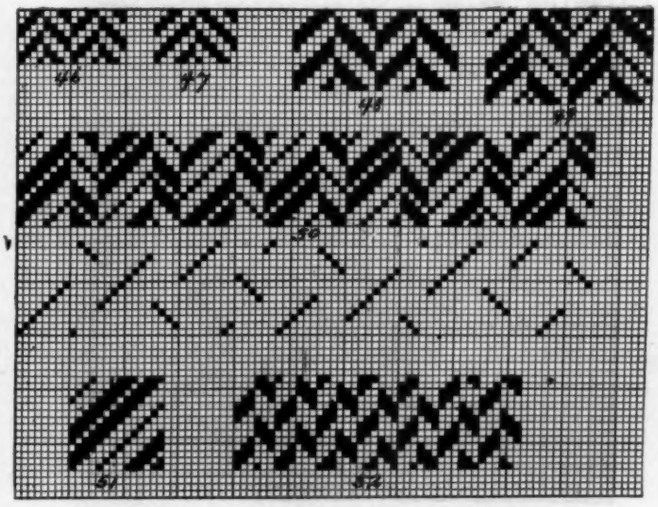
the warp entirely covers the filling, so that the face and back of the cloth are made from the warp. The rib lines, however, lie in the same direction in the cloth as the filling. A filling effect rib weave produces rib lines that lie in the direction of the warp, and the face and back consist of filling, the warp being entirely covered up.

Fig. 35 shows the two up and two down, plain rib weave, warp effect. In this weave every alternate warp thread is raised for two successive picks, and then lowered for the next two successive picks. The pattern repeats on two threads and four picks, the warp being drawn in the harnesses in the same manner as for a plain weave. The chain draft will be the same as the first two threads in the design. However, cloth from this weave can not be produced on two harnesses, as the warp is generally of very high textile and requires to spread out by using more harnesses. Two additional harnesses are also required for weaving the selvage.

Fig. 36 shows the two up and two down plain rib weave, filling effect. This weave is made on two harnesses, two threads side by side being drawn in No. 1 harness, while the next two threads are drawn in No. 2 harness. The harnesses are alternately raised and lowered at each pick of the loom in the same manner as in the plain weave. Figs. 37 and 38 show fancy rib warp effects, while Figs. 39 and 40 show fancy rib filling effects. The chief point in designing either warp or filling fancy rib weaves is the introduction of the plain weave between the rib effects.

Basket Weaves.

Basket weaves are simply a combination of warp and filling effect rib weaves, and like the rib weaves they can all be woven on two harnesses if desired. But it is not always practicable to do so, as there would be too many threads on one harness to make the work run good. Fig.



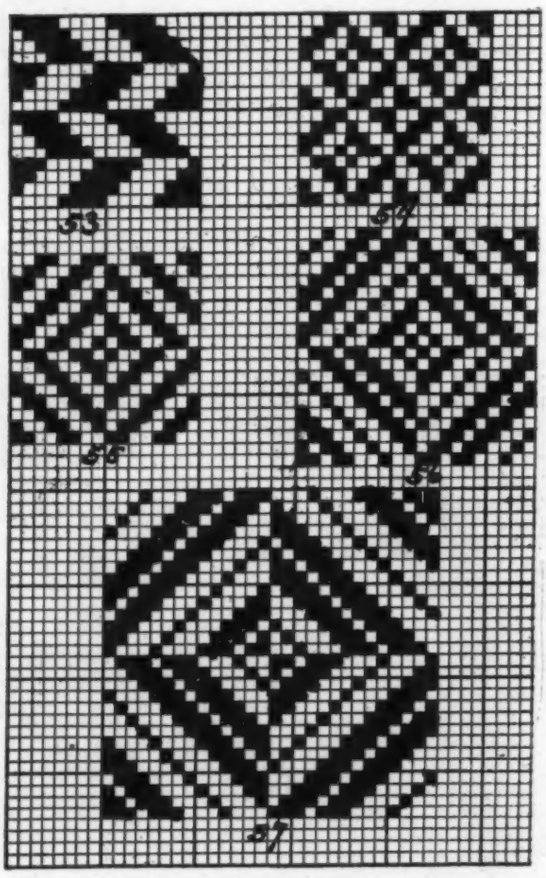
Broken Twill Weaves.

41 shows the three up and three down plain basket weave. Figs. 42, 43, 44 and 45 show fancy basket weaves. A great many weaves in this class are not practical, and are rarely ever used without some variation, because the threads would not be interlaced close enough and would produce a very flimsy cloth. These weaves are, however, very valuable as motives for table cloths, blankets, etc. For example, we might want to prepare a design for a table cloth, using the four-harness warp effect twill and filling effect twill for the weaves. If a fancy basket weave is taken as a motive, that is, let one filled in square of the basket weave represent one repeat of the warp effect (three up and one down) four-harness twill, and one empty square represent one repeat of the filling effect (one up and three down), a

very pleasing effect will be produced. In such an instance, one repeat of the pattern would be four times the size of one repeat of the motive. Most of the designs of this character are made from motives and the design will be a reproduction of the motive on an enlarged scale. In the same manner warp and filling effect satins are frequently used for the weave in a design made from a motive, for goods of this character.

Broken Twills.

Broken twills, broken warp ways will next be considered. These weaves are found very extensively in woolen and worsted goods. They are derived from regular twills and are formed by running the twill line in one direction for a certain number of ends and then reversing the direction of the twill for the required number of ends. The principal point that should be kept in mind in making broken twills is that the reversing point in the weave should cut perfectly (that is, a riser on the reversing thread should be opposite a sinker of the preceding thread, and likewise a sinker opposite a riser). This will produce a clean-cut appearance in the cloth and in order to produce this clean cut, even sided twills must always be used.



Fancy Broken Twill Weaves.

Fig. 46 shows two repeats of the four-harness even sided twill, broken four ends to the right and four ends to the left. Fig. 47 shows the same twill broken six ends to the right and six ends to the left. Fig. 48 is the six-harness, three up and three down twill, broken six ends to the right and six ends to the left.

Fig. 49 is a 14-harness twill, three up, one down, three up, three down, one up, three down, broken six ends to the right and six to the left. Fig. 50 shows the same 14-harness twill as in Fig. 49, broken eight ends to the right and four ends to the left. This design shows only one repeat of the pattern, which, as will be noted, is 84 ends and 14 picks. Underneath the design is the drawing-in draft, while the harness chain is shown at Fig 51. The drawing-in draft for this design is a little complicated and may be rather hard to understand. However, it is the simplest that can be made for the pattern. The simplest method for making the drawing-in and harness drafts for a broken twill is as follows: Design one repeat of the regular twill for the harness twill as in Fig. 49, broken eight ends to the right and with the chain draft. This will always give the simplest drawing-in draft, which, however, is sometimes badly mixed. Fig. 52 shows an uneven sided twill, broken warp ways. This example is the three up and four down, seven-harness twill, broken three ends to the right and three ends to the left. This weave does not cut perfectly, but such weaves are frequently used.

Broken twills, broken filling ways will now be explained. An example is given at Fig. 53, which is the eight-harness even sided twill, broken filling ways at every four picks. Next there are the broken twills which are combinations of the two systems explained, being broken both warp and filling ways. Fig. 54 shows the four-harness even sided twill broken at every four ends and four picks. Fig. 55 shows the same weave broken at every eight ends and eight picks. Fig. 56 shows the two up, one down, two up, two down, one up, and two down ten-harness twill, broken every ten threads warp and filling ways. Fig. 57 is a 14-harness twill, three up, one down, three up, three down, one up, three down, broken 14 ends in each direction. It will be noted that all of these weaves cut perfectly and this is the important fact to be considered in making them. There are an immense number that could be given, however, if these examples are studied, one can not help but grasp the idea of their construction.

(To be continued.)

THE COST OF COTTON MILL.

Editor Cotton: In looking over the articles published, I note that you have some very well informed men who write for your paper. Will you please submit the following questions to your readers:

What would be a reasonable cost for a complete mill of 150 plain looms on 36-inch, 48x48, 4-yard sheeting? The draft at each process is not to exceed the following: Spinning, 7.50; speeder, 5.80; intermediate, 4.80; slubber, 4.00; 1st drawing, 6.00; 2nd drawing, 6.00.

With the foregoing drafts, what would be weights of card and finisher drawing slivers, also the hank roving from the slubber intermediate and speeder? What warp and filling would be used to obtain the best results in weaving?

In making the calculation do not consider the cost of power or supplies. I do not ask these questions with any other than a good intention, as I think a paper so extensively read as Cotton should awaken a spirit of friendly discussion among its readers, and bring out ideas that will lift us up to a higher standard of mill operation. I want to tell your practical readers, not to keep their light hid under a bushel nor to keep the knowledge they have gained by experience to themselves as though it were exclusive information. Remember the saying of Solomon, that there is nothing new under the Sun.—H. W. T.

SIZING COTTON YARN.

Analyses and Properties of Starches—Uses and Application of Size to Yarn—Size Formulas.

(*Contributed exclusively to* Cotton.)

BY CHAS. A. HAEUSSLER.

Despite the strides made in organic chemical research, practically nothing has been published or made public regarding the positively wonderful properties of cornstarch for textile purposes. As a rule, users of starches for industrial purposes do not realize the chemical composition, the expense reducing power, or the effect of the particular kind of starch they are using.

The finisher generally realizes that a certain quantity of starch will increase the weight and tensile strength of the yarns and fabrics under operation, but he does not know the difference between the various starches. It is the purpose of this article to give some facts which may be verified, and which would seem to show, from a practical manufacturing point the basis for the claim made by corn starch advocates that it is superior to any of the other starches known to the industrial world. The statements made herein are based on practical experience and rigid and exhaustive research into the chemistry of starches and their industrial uses.

STARCH.

Starch is a vegetable carbohydrate which occurs abundantly in all plants, its general composition being $C_6 H_{10} O_5$ or some multiple of these numbers. The only means of distinguishing one starch from another is by microscopic examination, the differance in appearance, and the size of the granules. The average diameter of the starch granule is as follows:

Beetroot	.0016 inch
Millet	.0039 inch
Rice	.0087 inch
Corn	.0118 inch
Wheat	.0197 inch
Sago	.275 inch
Arrowroot	.550 inch
Potato	.728 inch

Starch granules are not dissolved by cold water, alcohol or ether, but when starch is heated with water from 114 degrees to 165 degrees Fahrenheit the granules swell and split open, forming a thick mass called starch paste or size. By boiling the paste with a larger quantity of water, the starch particles become so finely divided that they pass through a filter, and if boiled for a long time the solution becomes clear and the starch is rendered soluble. The following table shows the relative difference in the preparation of sizes of the different starches:

Mixed with water	Commences to swell	Paste formation begins; granules burst	Paste formation becomes perfect; size ready for use
Potato starch	114.6° F.	136. ° F.	143.6° F.
Corn "	120.2	131.	143.6
Wheat "	122.	149.	153.7
Rice "	129.2	138.2	143.6
Chestnut "	126.6	132.8	138.2
Rye "	113.	122.	131.
Sago "		150.8	159.8
Arrowroot "	150.8	150.8	165.2
Aurum "	122.	136.	143.6

STIFFENING POWER OF STARCHES.

It is claimed that the stiffening power of corn starch acts upon textile fabrics more uniformly than that of either wheat starch or potato starch. In the paste, the starch granules of wheat starch are contained in the form of gelatinous lumps, which are not so large as those of potato starch, and look better, but are not so smooth as cornstarch. It is said that the paste of corn starch remains unaltered if exposed to the air for about ten or eleven days, while potato starch paste, after a day's exposure turns acid, falls down, softens down, sours quickly, affects dyes, spoils a warp, and after a few days separates into a gelatinous mass, over which a watery and sour liquid forms.

Potato starch makes a size which is more or less stiff and harsh, requiring an extra amount of softening; also it does not penetrate the fiber or fabric thoroughly. Corn starch size is uniform in its results; gives body to both warp and fabrics; penetrates the fiber thoroughly; strengthens and gives handle and body feel to yarns and fabrics. Corn starch advocates state that the relative value of the starches for textile uses, taking corn starch as a basis, is as follows:

Corn starch	100 per cent.
Rye starch	94 per cent.
Wheat starch	94 per cent.
Barley starch	91 per cent.
Arrowroot starch	88 per cent.
Potato starch	80 per cent.
Sago starch	80 per cent.
Patioca starch	80 per cent.
Farina	76 per cent.

TO PREVENT THE DECAY OF STARCH.

Starch is not fermentable, but like all other organic substances is subject to decay, although to a lesser degree than many other organic matters. It becomes musty when stored in damp, poorly ventilated store-houses. This may be looked upon as the first stage of decay, easily remedied by allowing access of dry air to the starch. In general, corn starch withstands that tendency with greater energy than most other starches or vegetable substances. All starches decay easily and quickly after being made into a paste or size solution. The size, when exposed to the air in consequence of a milk-sugar formation, often sours. This can be prevented by the addition of acetic acid. Experience proves that corn starch size remains good and sweet for a longer period of time than any other.

APPLICATION OF SIZE TO YARN.

The process of sizing is very important in the preparation of cotton yarn. The cotton fiber in itself has not the closeness or tensile strength necessary to withstand the vibration and pull of the heddle in the weaving process; therefore, it requires a strengthening and lubricating material which will so thoroughly penetrate the fibers as to make them adhere to each other to give the tensile strength necessary to make a strong compact smooth thread. Successful sizing not only requires thorough saturation of the yarn, but also thorough and rapid drying without scorching, the proper distribution of the yarn, and the making of a hard, uniform, compact beam.

The value of the size lies in its ability to strengthen, lubricate and soften the yarn, so as to render it strong and pliable. If the yarn comes from the slasher too stiff or too soft it is difficult to weave well; poor production and a larger percentage of seconds result. Consequently,

uniform sizing is absolutely necessary. Weavers claim that half of the weaving is done in the slashing-room, for no skill at the loom can bring good results from a poorly-sized warp. The weaving-room is often blamed for lack of production and poor quality, when the trouble is caused by poor slashing. When the slasher is stopped too long, the yarn is burned or the size is cooked. Sometimes the size becomes thin by the condensation from the steam, and poor sizing follows.

Corn starch size is said to be the most uniform starch consistency, that is, the largest percentage of actual starch of any of the starches, and produces a more uniform size with greater penetrative powers. It has a greater affinity for cotton fabrics and is more economical for use as size, because less is required than with any other of the known starches. Of course, when corn starch is substituted for any other starch the quantity must be regulated in proportion to the starch value of the starch previously used. On account of the variations in potato starch it is very difficult to give tables applicable in every case. Renewal from practical use and experiment, however, shows that one pound of corn starch is equivalent to 1.2 to 1.7 pounds of potato starch.

Regarding the use of a softener in the size for lubrication consideration must be given to the humidity and temperature of the slasher-room, to the densities of the mixtures, quality and character of the ingredient, and above all the manner of boiling. The importance of sizing and preparation can not be overestimated as it does more to make the cotton mill profitable or unprofitable than any other department in the mill.

DEFECTS IN SLASHING.

Among the defects in the process of slashing are the following: Burning or scorching at the ends; imperfect drying by which the ends stick to one another on the beam; surface sizing in which the size lies on the surface of the yarn and is likely to be rubbed off in wearing, due entirely to the size being too thick; hard and boardy yarn; undersized yarn; soft beams; irregular or rough beams; beams with bad ends; excessive breakage of the threads. Too much waste in end pieces, and stains upon the yarn and discolored yarn.

Starch when cooked over destroys the qualities for which it is used. It must not get above the boiling point, otherwise it will sputter and little splotches will appear on the yarn as it goes on the beam. The secret of preparing size lies in the boiling. The moment it is thoroughly boiled the steam should be shut off. Starch to be applied to yarns should be of such a character that it will adhere to them firmly not only while wet, but after the yarn has become perfectly dry. It should also adhere to the yarn even when submitted to the chafing action of the working parts of the loom with which the work comes in contact. Whether for light, medium or heavy sizing, the size must be of a uniform thickness and consistency throughout, capable of saturating the yarn thoroughly, and giving a good color.

PREPARATION OF SIZE.

In order to produce a size that will give the results desired, intelligence and a thorough knowledge of the reason for using the various ingredients are absolutely necessary. It is particularly noticeable in a great many plants that not a man in the slasher room knows why a softener, antiseptic and whitening are used in the size. All they know is that so many pounds of starch, so many pounds of softener, so many measures of blue and so many ounces of antiseptic will produce a certain result. If changes should occur in the water or in any of the working conditions and trouble result with the sizing, a slasher room man would not know what to do. It is for this reason that in this day of modern progress the most intilligent help should be used in the slashing room and they should be taught why the various ingredients are used. They should know, for example, that an antiseptic prevents mildew in the fabrics; that softeners are used to reduce the harsh effects of the starch as well as to soften the yarn and lubricate the heddle eye. At the same time popular fallacy that certain starch must be used to produce certain results should be moved from their minds, because the value of the size lies in the starchy contents and not because of the name of the starch.

Size preparation is the mixing in the proper proportion of the various ingredients required to produce the results desired, and depends upon the class of fabric to be woven, and the ingredients to be used are regulated to suit the following conditions: twist of yarn, number of yarns, fabric to be woven and its uses, increase of weight required, humidity of the atmosphere in the weave room, and the character of the water used. These points being determined we know the ingredients as well as the consistency of the size required for the fabric.

Owing to the fact that it is necessary to vary the ingredients with a variation in the temperature and the character of the water used, it is impossible to give a list of proportions of ingredients that can be used under all varying circumstances. Sizings may be classified into light, medium and heavy.

Light:

Starch	35 to 50 pounds
Water	100 to 110 gallons
Tallow or oil	2 to 3 pounds
Chloride of zinc	3 to 5 ounces
Turpentine	1 gill
Bluing	1 gill

This sizing will add three to five per cent. weight to the yarn.

Medium:

Starch	45 to 52 pounds
Water	100 gallons
Tallow or oil	4 pounds
Turpentine	1 gill
Chloride of zinc	3 to 5 ounces
Bluing	1 gill

This preparation will add eight to ten per cent. weight to the yarn.

Heavy:

Starch	52 to 66 pounds
Water	100 gallons
Tallow or oil	3 pounds
Chloride of zinc	3 ounces
Bluing	2 ounces
Turpentine	1 gill

This preparation will add from 12 to 15 per cent. to the weight of the yarn.

More starch in proportion to water stiffens the size and coats the yarn. It does not impart strength, and rubs off in the process of weaving. Less starch makes the size penetrating. When the warp is not pliable, increase the softener in proportion to the amount of starch and water used.

WOOL MANUFACTURING.

WOOLEN MILL PRODUCTION.

(*Contributed exclusively to* COTTON.)

BY O. F. IRELAND.

The question of production in the woolen mill is of equal importance with that of either buying or selling, and should not be overlooked in the calculation of cost or the endeavor for success. The calculation of cost is of great importance, and while it has been a subject of much careful study, there has never yet been, and probably never will be a system devised that will be absolutely accurate and reliable. There are so many things happening that can not be foreseen or anticipated, that one often finds himself at sea, or learns when too late that he has not made suitable allowance for contingencies. Yet this is no reason why one should abandon a system; but rather it should teach him to endeavor to make suitable allowances for the unforseen possibilities of the business.

One of the difficulties which are met is the uncertainty of the selling end of the business, and the unfavorable turns of the market, which result in a lack of sufficient orders to keep the mill employed to the full capacity of the plant. By keeping a careful account of the expenses of each department of the mill, and a regular tabulation of cost per pound of stock and yard of goods made, as applied to these various departments, as material, labor, insurance, taxes, interest, etc., it is not very difficult to tell what the cost has been, of goods already made, and if it were possible to foresee the production of the mill in advance, estimates might often be more accurate and reliable than they sometimes prove to be.

We wish to call attention to the probable production of the mill, and as this is very largely dependent upon the orders received, it throws the responsibility upon the selling end of the business. But if the orders are sufficient to keep the mill employed to its full capacity, it is then the management's duty to get the work through. In making his calculation of cost, the manager of the mill figures upon a basis of a certain production, such as he knows the mill is able to turn out, of the class of goods to be made. If the orders received fall below this calculated production, it has a more direct and damaging effect upon the possible profits than almost any probable lack in the buying or the management of the mill.

It is an easy matter for a practical manager to figure the capacity of the mill for a season, and having the proper data, to calculate the cost of the goods. But if the orders received fall 25 per cent. below the production he has figured upon, he is powerless to make the results meet his calculations; for with only three-quarters of his full production, the cost per yard must necessarily be increased beyond the original estimate, and it does not require any very great shortage in production to eliminate the possibility of a suitable profit and render the season a loss to the mill.

There are certain expenses in connection with the making of any line of goods that remain about the same per yard, whether the production be large or small; but there are others that are very materially affected by a shortage. If the list price for weaving be six cents per yard, it remains the same regardless of the production; and the same is true of any work done by the yard, pound or piece.

But this kind of work seldom constitutes one-half of the wage expense, and in some parts of the mill a full force of day help is required, though the production be small, which of course, adds to the cost. In the larger mills it is sometimes possible to lay off help when the work is slack, but in the mills of moderate size, where only one man is employed on any particular work, as fireman, picker, fixer, fuller, etc., he is not only able to take care of his part of the work at any time, but he must be kept on when the production is low; and though the daily cost is not changed, the cost per yard is increased as the production decreases.

The expense of the organization can not be done away with nor cut down; and the most expensive help, as overseers, second hands, fixers, etc., must be given full time, and the salaries, office expenses, insurance, taxes and many other items are bound to go on, and count in the increased expense of a low production. Sometimes the mill management is blamed, and the superintendent considered to be at fault, when the mill has failed to show a profit, and the ordinary looker-on fails to recognize the fact that conditions over which he has no control have upset his best plans and calculations. If a mill is able to turn out 5,000 pieces in a season, and the cost is figured on that basis, and orders come to the mill for only 3,000 pieces, the result must necessarily be disappointing. This is no overdrawn supposition, and the writer could name mills that have been forced out of businesses just because they were obliged to run at "a poor dying rate," while their competitors were hustling and turning down orders.

Even though the manager could know that he would have only 75 per cent. of the mill's capacity in the way of orders, it would not remedy the matter; for he would be obliged to place a price upon the goods that would give his busy competitor the advantage in the market. As an illustration of what can be done by an increase in production, a case is called to mind that came under the writer's observation some years ago. It was during a time of extreme depression, when mills all over the country were cutting down wages in order to keep running, with little hope of profits until there should be a change in the conditions. A certain mill in New England, running about 20 setts on a popular line of dress goods, had a promising outlook for orders; but in common with others, saw little chance to make a profit, and the help were expecting daily to be notified of a cut-down in wages, when word came from the managing director to the superintendent to exert every effort to increase the production, in the hopes that a reduction in wages might be avoided. This notice was so encouraging to the help that the superintendent found little difficulty in securing the willing co-operation of all the help in his endeavors, and the result was that the production per month advanced from 80,000 to above 100,000 yards, and the mill made a very fair profit, while many other mills were finding it hard to continue even with a reduction in wages.

KNITTING

THE PRINCIPLES OF KNITTING.

Analysis of Knit Goods—Plain Stitc on Latch Needles, and Spring Beard Needles—Rib Stitch on Latch Needles, and on Spring Beard Needles—Tuck Stitch—Full Cardigan Stitch.

(*Contributed exclusively to* Cotton.)

by knitter.

Woven goods, knit goods, and lace constitute the chief classes of fabrics used in the production of wearing apparel. Each style has its distinguishing characteristic in regard to its appearance, and is readily recognized as to the class to which it belongs, except in a few instances where one style has been made in an effort to imitate the goods of another class. Woven goods are easily recognized as such by the fact that one system of threads interlaces with another system at right angles, forming a fabric which is more or less in elastic, according to its sheerness. Woven goods for wearing purposes may be said to be practically inelastic.

Knit goods are distinguished by the interlocking of loops of yarn to form the fabric, and by their elasticity. They are also characterized by their method of manufacture, using primarily only one thread which, by a system of loops engaging with each other, forms a fabric that is very elastic, owing to the fact that the loops are not drawn together as tightly as in the case of woven goods. Although one thread is sufficient for knitting a fabric, for the purpose of increasing the production of a knitting machine as many as sixteen threads are fed to certain types of machines at one time, each thread being knitted into the fabric in a manner similar to that used where only one thread is employed.

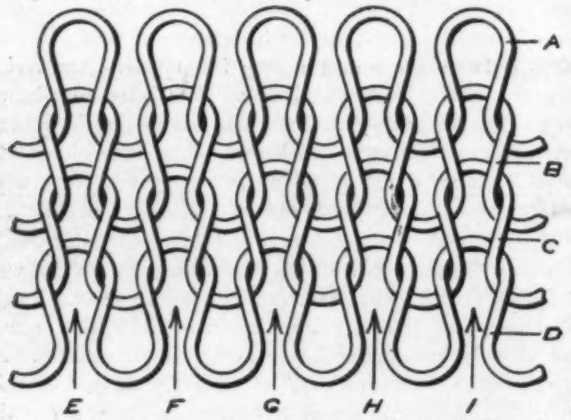
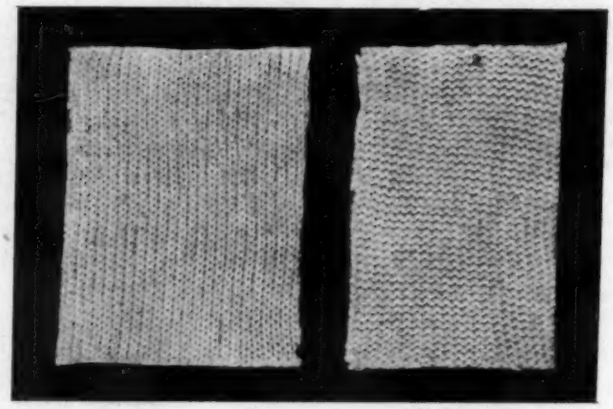


Fig. 1. Diagram of a Plain Knit Fabric.

As there are three foundation weaves from which practically all patterns for producing woven goods are obtained, so also in knitting we may say that there are four foundation stitches that constitute primary systems of loops and from which by combinations and derivations all descriptions of knit fabrics are made. The four foundation stitches are called respectively the plain or knit, rib, half cardigan and cardigan stitches.

These various stitches are used very extensively in the production of the following articles: The plain or knit stitch is used for making ladies' hosiery, the lower portion of men's half-hose, jerseys, and balbriggan underwear. The rib stitch is found in children's ribbed stockings, the upper portion of men's half-hose, sleeves, and ribbed underwear. The half cardigan stitch is used for making sweaters, and in shaping underwear, and the full cardigan for cardigan jackets.



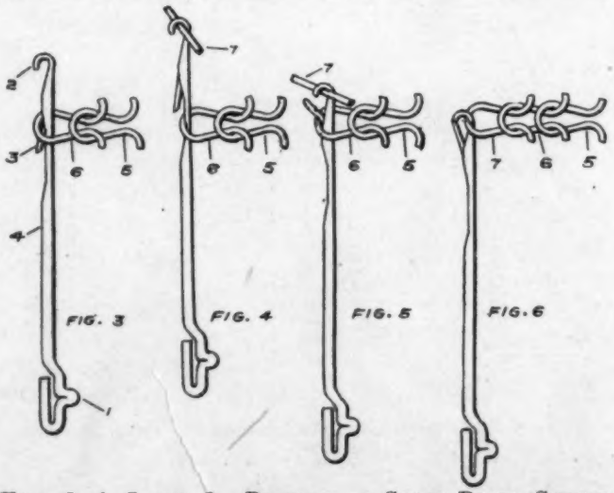
Face. Back.

Fig. 2. Sample of Plain Knit Fabric.

As the production in knitting mills is confined to machine knitting, the following explanations of the methods of making the different stitches will be given in connection with the two well-known types of knitting needles used in knitting machines, namely, the latch needle, and the spring beard needle.

THE PLAIN STITCH ON THE LATCH NEEDLE.

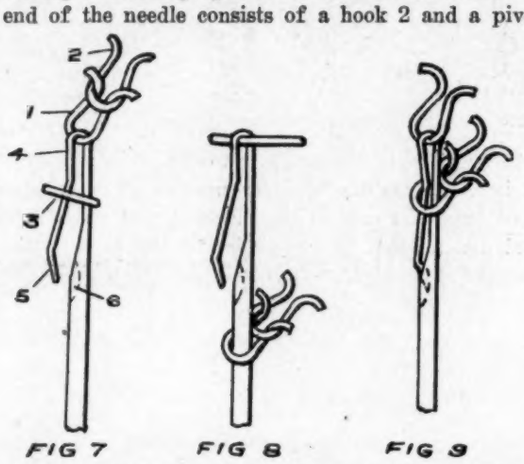
A diagram of a section of a knitted fabric using the plain stitch is shown in Fig. 1 which illustrates the method of looping the thread to produce a firm and elastic plain fabric. The diagram represents a section of a circular fabric, and each horizontal line of loops A, B, C, D, represent one course of stitches that is produced for every revolution of the yarn carrier on the machine. Each of the



Figs. 3, 4, 5 and 6. Diagram to Show Plain Stitch Formation.

vertical rows of loops E, F, G, H, and Z, represents the work of one needle in the machine. A sample of a plain stitch fabric is shown in Fig. 2. The method of forming the plain knit stitch by means of a latch needle is best shown by referring to Figs. 3, 4, 5, and 6 which are diagrams to show the position of the needle and yarn in the successive stages in the production of the stitch.

Fig. 3 represents the position that a loop occupies when the needle is in its resting position after having completed a previous stitch by casting it off. The needle works in a vertical slot in the needle cylinder of the knitting machine, said needle being actuated up and down by means of a revolving cam acting upon the butt 1 of the needle. The top end of the needle consists of a hook 2 and a pivoted



FIGS. 7, 8 AND 9. DIAGRAMS TO SHOW STITCH FORMED BY A SPRING BEARD NEEDLE.

latch 3 which assists in making the stitch. The latch, when stationary, occupies one of two positions, namely, as shown in Fig. 3 in which it is resting upon the stem 4 of the needle, leaving the hook 2 open and in position to receive the yarn when fed; and as shown in Fig. 5 when it rests upon the end of the hook 2, thus enclosing the yarn and also providing a means of letting the loop resting on the stem pass over the hook and be cast off.

The loop 5 was made from the yarn fed at the previous revolution of the yarn carrier, being now in condition for casting off; and the loop 6 represents a stitch that has just been completed and cast off ahead of loop 5. As the cam cylinder revolves, a lifting cam raises the needle into the position shown in Fig. 4, thus having the loop 5 resting on the stem 4 below the latch 3, and at the same time the hook 2 is in a position to receive yarn from the yarn carrier.

After the yarn 7 has been fed to the needle hook, a cam begins to lower the needle as shown as Fig. 5. The action of the lowering of the needle in sliding through the loop 5 is to cause said loop to close the latch 3 over the open hook, due to the fact that the end of said latch 5, projects above the loop 5, and the needle in sliding through the loop causes the latch to be thrown over by the loop. The loop 5 is thus free to pass over the hook containing the yarn 7, which as soon as the said loop 5 is cast off of the needle, is in the form of a stitch similar to loop 5 in Fig. 3.

The needle is lowered by a cam until it reaches the position shown in Fig. 6, that is, the loop 5 is "cast off" and forms a completed stitch. From this position the needle is raised again to the resting position similar to Fig. 3, and the loop 7 will then undergo the same operation as explained for stitch 5.

PLAIN STITCH ON THE SPRING BEARD NEEDLE.

The explanation of the production of a plain stitch on

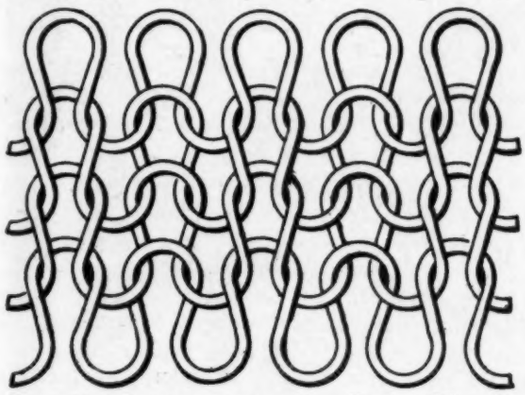
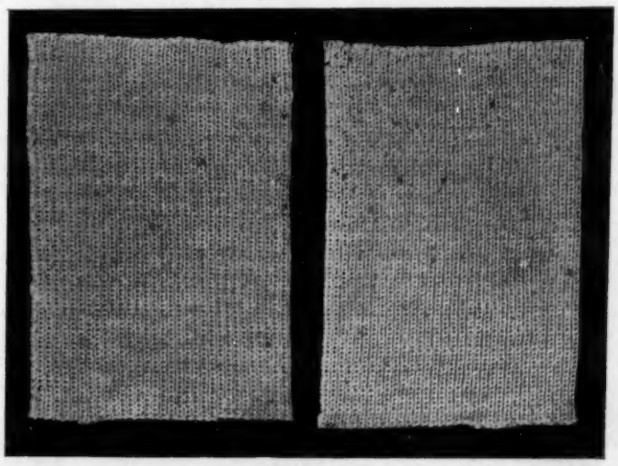


FIG. 10. DIAGRAM OF A RIB STITCH FABRIC.

a latch needle plainly showed that one of the most important features was to have a hook for holding yarn while a loop was cast off over this yarn thus having the latter to form another loop. The same general principle holds good for the spring beard needle, that is, a hook is provided at the top end, but the style of hook used and the method required for producing the stitch is quite different from the latch needle method. In making the stitch with latch needles the latter are actuated vertically by cams moving laterally in a circle, while the fabric and loops remain practically stationary. With the spring beard needles, the needles do not move vertically but revolve laterally with



Face. Back.

FIG. 11. SAMPLE OF A RIB STITCH FABRIC.

a cylinder and the loops are moved vertically by means of fixedly located "burs."

The production of a plain stitch on a spring beard needle is shown by means of Figs. 7, 8, and 9. Fig. 7 shows the position of the loop 1 in the needle hook 4 when the cylinder has revolved to where the yarn 3 is fed to the needle. The loop 2 represents a completed stitch. It will be noticed that the yarn 3 is resting against the outside of the spring beard 5. As soon as the yarn is thus laid on the needle, a bur acts upon the loop 1 and the yarn 3 to depress them below the point of the spring beard. The loop 1 will occupy the position shown in Fig. 8 and the yarn 3 will go up into the hook of the needle as shown. The

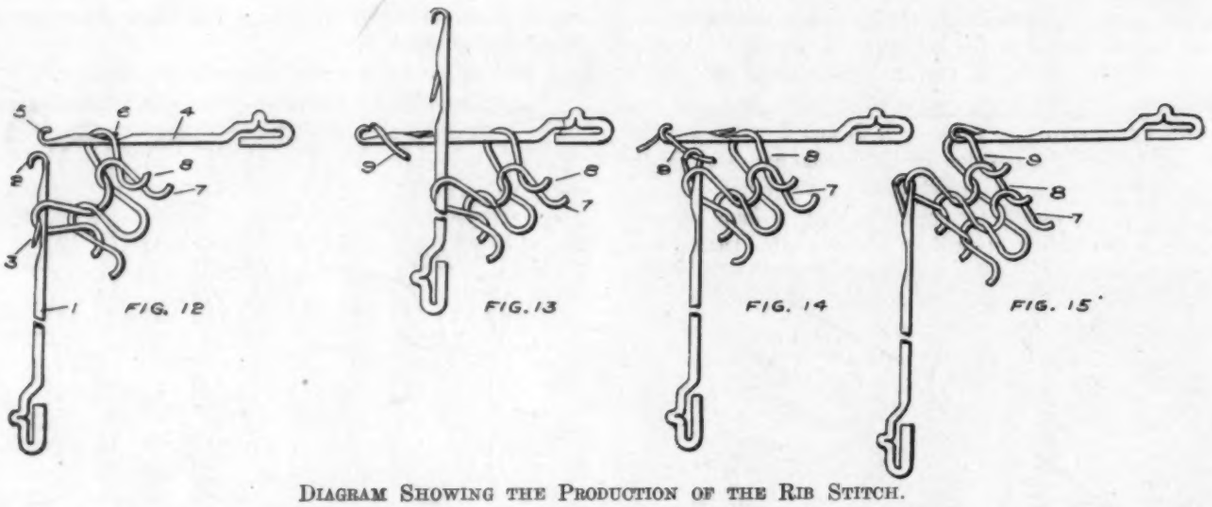


Diagram Showing the Production of the Rib Stitch.

needle cylinder revolves rapidly, and the different operations follow each other very closely. By the continued revolution of the needle cylinder the spring beard is acted upon by a bur which presses the lower end into a small slot 6 and closes the hook, leaving the loop free to be raised over the hook to be cast off. A cast-off bur almost simultaneously raises the loop 1 as shown in Fig. 9, and from there it is cast off, thus forming a new stitch and having the loop 3 in the hook to go through the same process as explained. The needles are located on the cylinder with small spaces between them, the size depending upon the gauge of needles used. Thus, what has been explained for one needle takes place similarly on all of the needles, and the knitted fabric is thus formed.

Rib Stitch on Latch Needles.

The second class of knit stitch, known as the rib stitch, differs materially from the plain stitch in appearance and in the method of production. Fig. 10 is a diagram of a section of a fabric showing the rib stitch formation, and Fig. 11 is a sample of what is known as the one-and-one rib stitch fabric. The appearance of the fabric is characterized by the rib lines running in the direction of the length of the goods, and by the fact that both sides of the fabric have the same appearance.

In the production of a rib stitch it is necessary to have two sets of needles working on the same thread and at right angles to each other. One set is placed vertically in the needle cylinder similarly to the plain stitch method, and is known as the cylinder needles. The other set is placed in a dial cap on the machine, and the needles are called dial needles. The cylinder needles produce the ribs

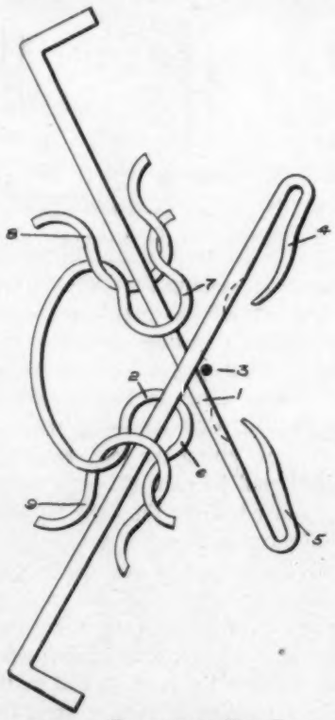


Fig. 17. Diagram for Producing Rib Stitch on a Spring Beard Needle.

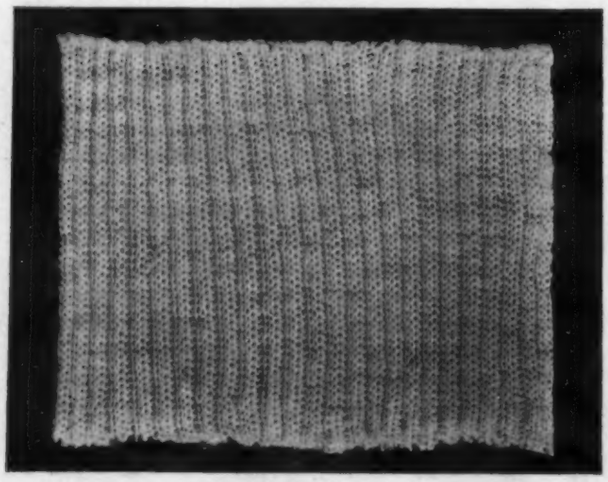


Fig. 16. Sample of 2 and 2 Rib Fabric.

on the face of the fabric, and the dial needles make the ribs on the back, the same being indicated in Fig. 10 by the rows A and B respectively.

The method of making the rib stitch is shown by means of Figs. 12, 13, 14, and 15, which are diagrams of the four principal positions of the two needles during the production of a stitch. Referring to Fig. 12, 1 indicates the cylinder needle having the regular hook 2 and latch 3. This needle is actuated vertically by the cylinder cams in a similar manner to that used for the plain stitch. The dial needle is indicated by 4, having its hook 5 and latch 6. The dial needles are somewhat shorter than the cylinder needles. Fig. 12 shows the position occupied by the needles while the resting portion of the cams are moving over the

butts of the needles. As the cam cylinder and dial cap revolve, cams act upon the needles, moving the cylinder needle 1 upwardly, and the dial needle 4 outwardly, so that they take up the position shown in Fig. 13. At this point the yarn carrier feeds the yarn 9 to the dial needle 1 as shown.

The cylinder needle is then operated downwardly, and the yarn 9 is caught by the hooks 1 and 2 as shown in Fig. 14. Immediately the yarn is caught in the hook 2, the

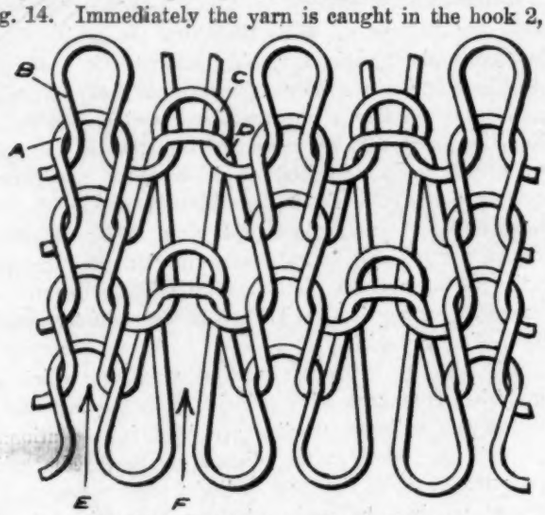
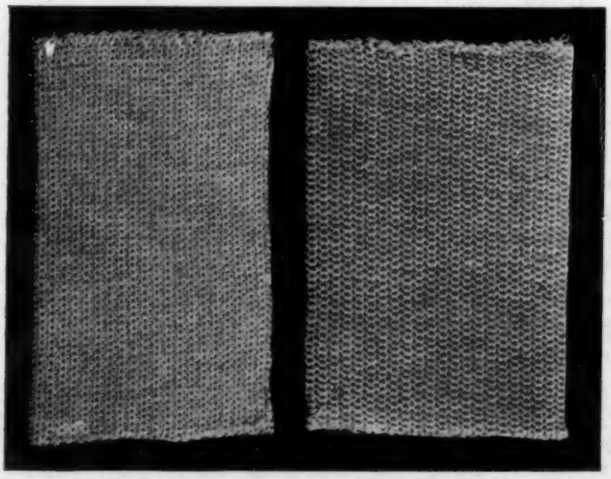


FIG. 18. DIAGRAM OF TUCK STITCH.

dial needle 4 is drawn inwardly with the yarn 9 also in its hook 5. The continued movement of the two needles 1 and 4 passing through the respective loops on their stems serves to close the latches over the hooks of the needles and allows the said loops to be cast off as shown in Fig. 15 leaving the yarn 9 in the hooks in the form of loops. The cams then actuate the needles sufficiently to put them again in the positions shown in Fig. 12 when they are again ready to receive another course of yarn and repeat the operation of forming the stitch.



Face. Back.

FIG. 19. SAMPLE OF TUCK STITCH.

Variations of the one-and-one rib stitch may be made by changing the succession of face and back ribs, such as 2 and 1, 2 and 2, etc., by which is meant in the first instance that two rib lines appear together on the face of the fabric with one rib line on the back. A rib line on the face makes a corresponding depression on the back, and vice versa, so that 2 and 1 rib would show a series of two rib lines and one depression on the face of the fabric, and one rib line and the space of two depressions on the back. A sample of the 2 and 2 rib fabric is shown in Fig. 16.

RIB STITCH ON SPRING BEARD NEEDLES.

The production of a rib fabric on spring beard needles requires two sets of needles which are placed to work at an angle of about 120 degrees between them as shown in Fig. 17. These two sets of needles are carried in separate needle cylinders which revolve together. The needles are also actuated up and down by means of cams on the machine, and one bur is used to press the needle hooks to allow the stitches to be cast off. It will thus be seen that a spring beard rib machine differs materially in principle from the plain knitting machine.

Referring to the diagram Fig. 17, 1 indicates a spring beard needle working in the top needle cylinder, and 2 is a needle in the bottom cylinder. The diagram represents the positions of the needles at the time the yarn 3 is fed to them. Immediately after the yarn is fed to the needles they are actuated to bring the hooks 4 and 5 respectively down over and up under the yarn 3. When the yarn gets into the hooks, the latter are closed by the presser bur, and

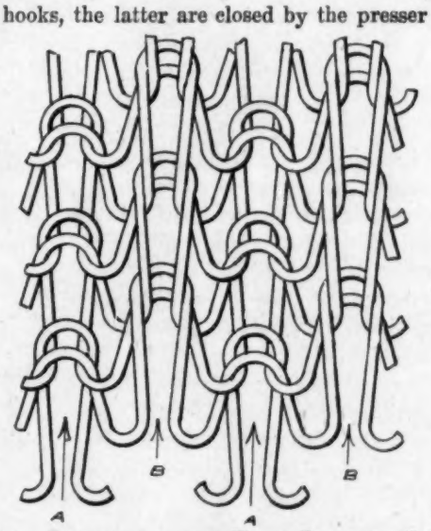


FIG. 20. DIAGRAM OF THE FULL CARDIGAN STITCH.

they are thus enabled to continue their respective movements, and allow the loops 6 and 7 to be cast off. After casting off the loops the needles are actuated to their original positions to receive another course of yarn for continuing the knitting operation. The diagram shows the loops distorted, and in the actual fabric the loops 8 and 9 would be made from the same yarn.

THE TUCK STITCH.

The tuck stitch is variously known as the royal rib, or the half cardigan, and may be termed a variation of the rib stitch. A diagram of the stitch is shown in Fig. 18 and a sample of the knitted fabric is given in Fig. 19. By referring to Fig. 18, it will be seen that the rib stripe A is similar to that made by the cylinder needles of the rib machine, and that stripe B is composed of loops so interlaced that two stitches C and D are cast off over one loop. This stripe is made by the dial needles of the machine in a similar manner to making a regular rib stripe, except that instead of casting off a loop at every course, one loop is retained on the hook until two loops are formed and then

the two loops are cast off together over the single yarn in the hook of the needle.

This stitch is generally made on a sleeving machine that is equipped with two feeds. It is more elastic than the rib stitch and is used in connection with the rib stitch for shaping underwear, and for making wrists and anklets where it is desired to have these portions tighter than the other portion of the garment.

FULL CARDIGAN STITCH.

This stitch naturally follows from the tuck or half cardigan stitch, and is made by operating both the cylinder and dial needles in a similar manner to that used for the dial needles for the half cardigan. In other words the cylinder needles cast off two loops at every other course, and the dial needles cast off two loops at every other course, alternating with the cylinder needles in casting off. A diagram is given in Fig. 20 showing the interlacing of the loops. The stripes A are made by the dial needles and stripes B by the cylinder needles. This stitch produces an even sided fabric, that is the face and back are the same.

MACHINE KNITTING.

CLASSIFICATIONS OF KNITTING MACHINES—HAND AND AUTOMATIC MACHINES—LATCH AND SPRING BEARD NEEDLE MACHINES—CIRCULAR AND FLAT MACHINES—PLAIN AND RIB-KNITTING MACHINES.

Knitting machines may be divided and sub-divided into different classes, according to their construction and use. The two great classes are the hand-knitting machines and the automatic machines. These two classes are important, because both styles of machines are extensively used in the knitting industry. It may be said, however, that the automatic machines find more extensive use in America than the hand machines.

The automatic machines may be divided into different classes to indicate what style of fabric they are suited to produce, and to designate the degree of automatic operation of which they are capable. Thus, there are the ¾ automatic, the ⅞ automatic, the 15/16 automatic and the full automatic machines, the names indicating to what extent the machines will operate without assistance from the operative, in the production of the desired fabric. A ¾ automatic machine requires more attention from the operative than a ⅞ machine, and the full automatic performs all of the operations automatically when the belt is on the tight pulley.

Knitting machines are further divided into two classes, according to the style of knitting needle used, namely latch needle knitting machines, and spring beard needle knitting machines. This classification may be said to be more distinctive than the degree of their automatic operation, because the majority of knitting machine builders confine themselves to latch needle machines, or spring needle machines, whereas, one machine builder may manufacture ¾, ⅞, 15/16, and full automatic machines of the latch needle type.

Knitting machines may be further classified as to the general type of machine such as circular machines, and flat machines, indicating that the goods are made in tubular form in the first instance, and that the fabrics are straight or flat in the second instance. Some flat machines, however, are capable of producing a tubular fabric. Full-fashioned machines produce flat work.

Circular machines may be divided into two general classes, namely, the plain knitting machine, which uses only one set of needles, and the rib knitting machine, which requires two sets of needles for the production of the rib fabric. These two general classes are further divided, according to the special work for which they are used. Thus, there is the seamless hosiery machines, and the underwear machine for balbriggan work that knit the plain stitch; while among the machines making the rib stitch are the rib top machine, rib shirt machine, plain body machine, ribbed border machine, sleeve machine, fleecing sleever, etc.

For the production of mens' half-hose which are composed of rib tops and plain knit bottoms, the former have to be made on a rib top machine and the plain knit portions and feet are made on the plain hosiery machine. There has lately been introduced a machine for knitting both the rib top and the plain portion, which elimnates the the operation of putting the rib top on the cylinder needles of the hosiery machine.

There are two types of knitting machines which are distinguished from each other principally by the fact that in one style the cylinder needles are held in a stationary needle cylinder, while in the other style the needle cylinder revolves having the cam cylinder stationary. The theory of making the plain stitch was explained in the article on "The Principles of Knitting;" now the practical methods of producing the plain stitch on different makes of machines will be given.

BRINTON'S FULL AUTOMATIC SEAMLESS HOSIERY MACHINE.

This machine is used in the production of ladies' hosiery, half hose, or for footing children's ribbed-leg stockings. It is built in sizes from 2¼ to 4¼ inches, varying by one-quarter inch and with any number of needles required for the class of work to be produced. It is entirely automatic in all of its actions for making the stocking, and on ladies' hosiery it runs continuously, passing from one stocking to the knitting of another without any manipulation on the part of the operator. In the production of half hose, it completes the work automatically; it, of course, must stop at the end of each half hose so that another cylinder containing a ribbed top upon the needles, may be introduced into the machine. This machine, as with all other plain knitting machines, contains only one set of needles, that is, the cylinder needles which are placed vertically in the slots of the needle cylinder. A set of sinkers, which work horizontally above the needles, is used to push the stitches from the needles as they are produced in the casting off process during knitting, there being one sinker for every needle. For the production of the different parts of a stocking and half hose, a pattern drum and a pattern chain are used for automatically changing the different mechanisms to produce the desired results. The pattern chain is used to control the revolution of the pattern drum to give the desired length of fabric of the different stitches, thus allowing of a variation in the length of stocking and the length of the foot as may be desired. In the production of a stocking, four different portions are necessary to be used, namely, knitting the leg, heel, foot, and toe. The leg and foot are produced by plain knitting with a

continuous rotation of the cam cylinder and yarn carrier, while the production of the heel and toe requires a reciprocating motion of the cam cylinder and yarn carrier with a special operation of the needles, besides having the needles in one half of the cylinder entirely out of operation during the knitting of these portions.

KNITTING THE LEG.

As the production of a stitch is dependent upon the action of the cylinder cams upon the butts of the cylinder needles, a development of the cam cylinder is given in Fig. 1, showing the relative positions of the cams, and the course the butts of the needles take as they are acted upon consecutively by the different cams. It may be well to mention at this time that one half of the needles in the cylinder are made with long butts and one half with short butts, the object of which is to have one half of the number of needles raised out of position at the proper time so as not

BRINTON'S FULL AUTOMATIC HOSIERY MACHINE.

to be operated upon by the cams during the two operations of knitting the heel and toe.

Referring to the diagram, Fig. 1, the dotted line indicates the course the butt of each needle takes in one revolution of the cam cylinder. When the cam 1 is acting upon the butt of a needle, said needle is in the position shown in Fig. 3 on page 280. The continued revolution of the cam cylinder then brings the switch cam 2 against the butt of the needle, thus raising the needle and causing the loop in the hook to open the latch, which needle is then carried to its highest position by the stitch cam 3 and the loop is in the position shown in Fig. 4 on page 280. The eye in the yarn carrier, which revolves with the cam cylinder is located so that the yarn is fed for the needle at this point on to the sinkers which are in position to receive the yarn when said needle is in its highest position. The needle is then ready to be lowered so that the yarn will be engaged by the hook of the needle, and for this purpose a top cam 4 is used, which starts the needle on its downward travel. The butt of the needle is then acted upon by the stitch cam F which carries the needle to its lowest position, causing the loop to assume the position shown in Fig. 6 on page 280, that is, the loop is cast off and becomes a stitch. The action of the cam 6 on the butt of the needle brings the needle up to its resting position on the cam 1, in which position it is ready to begin the operation of producing another stitch in a similar manner.

It will now be noted that there are provided similar cams oppositely placed to those mentioned, they are used during the knitting of the heel and toe when the cam cylinder is reciprocating, first in one direction and then in the other. The switch cams 2 and 7 are spring controlled so that the butt of the needle coming up under the cams easily raises them and they immediately fall back into the same position as previously occupied, thus enabling the butts of the needles to travel over the proper cams at the next reciprocation of the cam cylinder.

The continuous circular motion of the cam cylinder and yarn carrier will continue until the proper length of leg has been knit, which will be governed by the pattern chain, and it then becomes necessary to knit the heel of the stocking.

KNITTING THE HEEL.

It has previously been mentioned that one half of the number of needles used in this machine have long butts and one half short butts. The long butt needles are so constructed that they may be acted upon by a cam to raise them out of the line of the regular cams, and at the same time the short butt needles are not effected by the raising cam. This procedure is necessary in order to knit the heel with the required amount of fullness and give the foot the proper shape. It should be borne in mind, however, that the work of the needles that were raised out of operating position remains on said needles so that when they are again brought into operation, the knitting continues uninterrupted. A diagram of the stocking is given in Fig. 2, which shows clearly what is necessary to be done by the machine in order to give the proper shape to the foot. Referring to the diagram, the line A B C represents the end of the leg and the beginning of the foot. The line AB represents one quarter of the circumference at that point, there being another quarter, of course, on the opposite side of the stocking, which together represent the portion where the needles remain inoperative during the knitting of the heel. It will be understood that when speaking of the heel we refer to the entire heel, one half of which is only shown in the diagram. In knitting the heel the fabric is narrowed at every stitch by alternately placing one needle out of working position at every stitch, and when the stitch in course DE is reached it is perceptibly shorter than the first stitch of course BC. As these different needles are carried out of working position the loop remains on the body of the needle so that when said needle is again brought into working position there will be no interruption in the joining of the loops of the remaining portion of the heel. When the heel has been knit down to the point, at which

point about one half of the needles used are out of operation, the lower section of the heel is commenced and the widening process begins, that is, the needles that were alternately taken out of operative position are again brought back into position alternately, one additional needle for every stitch. When this process has been completed the heel portion is finished and the foot, which is knit by a continuous revolution of the cam cylinder acting upon the required number of needles, is ready to be made.

The method of operating the needles to produce the heel is best explained by referring to Fig. 1. The cam cylinder receives its circular motion from a bevel gear which is controlled by a clutch which operates to have the bevel gear revolve continuously or receive a reciprocating motion, according to its contact. The continuous revolutions of the bevel gear is obtained directly from the driving shaft of the machine, while the reciprocating motion is obtained through a toothed segment which receives a forward and backward movement through its crank pin driven from the driving shaft of the machine. When it is time to knit the heel, the position of the pattern drum actuates the cam 8, bringing it sufficiently into the plane of the cylinder cams to have it operate upon the long butt needles, which action raises them to a point where they can not be operated upon by the regular cylinder cams. The raising pick cams 9 and 10 are also brought into working position at this time on the pattern cylinder. In their freed positions the lowering pick cams 11 and 12 the projections extend just above the butts of the inoperative needles and when the cam cylinder is moving in the left hand direction, the pick 11 engages the butts of two needles previously raised by the pick 10, and as the cam cylinder continues its motion, the needles are brought down by the pick 11 into operative positions, at which point the pick 11 is automatically released and regains its original position after remaining under the butts of the inoperative needles until they have been passed. On the return reciprocation of the cam cylinder the upper pick 10 carries one of the returned needles back to its inoperative position that was returned by the pick 11 at the previous reciprocation of the cam cylinder, the lowering pick 12 carrying two needles from the other end back into working position in a similar manner as explained for the pick 11. On the forward reciprocation the pick 9 returns one of these needles to an inoperative position, leaving one needle added to the number of operative needles. This procedure continues until all of the needles for knitting the heel have been returned to a working position or until the stitch BG in Fig. 2 has been made. The foot is then ready to be made.

At this point the pattern barrel operates mechanisms to throw the clutch in with the continuously revolving mechanism which revolves the cylinder in one direction. At the

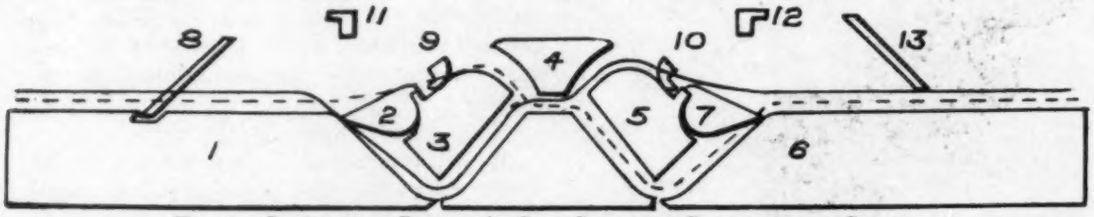


Fig. 1. Diagram of Brinton's Cam Cylinder, Showing the Cams.

and as the cam cylinder makes one reciprocation in the left hand direction, the switch cam 2 acts upon the needles as usual to raise them and the first needle lodges on the pick cam 9. The continuous revolution of the cylinder causes the pick cam to swing upwardly, taking the needle lodged on it at the same time. The remainder of the needles follow the path shown by the dotted line, the pick cam 9 resting upon the top of the butts of the remaining needles without affecting their positions. The return reciprocation of the cam cylinder causes the switch cam 7 to act upon the needles, and the butt of the first needle lodges on the upper pick cam 10 which carries said needle out of operative position similarly as explained for the cam 9. The remainder of the needles take the course shown by the solid line, the pick cam 10 resting on top of the butts without disturbing the position of the needles. Thus, for each reciprocation one needle is thrown out of operation and the fabric knitted is narrowed to that extent.

In order to complete the remaining half of the heel the latter has to be widened by bringing the needles back into operation, one at a time. This is accomplished by means of the lowering of the pick cams 11 and 12 in connection with the upper pick cams 9 and 10. The lowering pick cams will lower two needles at every reciprocation, but the upper pick cam will place one of these needles out of operation, so that the net result is only one needle placed into operation. The lowering pick cams 11 and 12 are brought into working position by means of a projection same time the picks 9 and 10 and 11 and 12 are made inoperative and as the cylinder revolves, the needles on the other half of the cylinder that have been out of working position, due to being raised by the cam 8, are brought again into operative position by means of a lowering cam 13. As previously mentioned the loop is retained on these needles while they are in an operative position, and the circular knitting now continues without any break in the stocking. Any required length of foot may be attained by the proper arrangement of the pattern chain. When the proper length has been made, the different mechanisms are operated by the pattern drum, the cam cylinder is again reciprocated with one half of the needles in an inoperative position, and the toe is made in a similar manner to the heel. For making stockings the machine is not required to be stopped at the completion of the toe, but continues in operation beginning a new stocking and knitting it in a similar manner to that just explained.

KNITTING HALF HOSE.

The knitting of half hose, which is composed of a ribbed top and plain leg and foot, requires that the cylinder needles should have the loops of the ribbed tops placed upon them before the plain knitting can begin. The needle cylinders are, therefore, made removable, so that the ribbed top may be placed on one set of cylinder needles by a topper while a set of needles previously topped is in operation in

the machine. It is, therefore, necessary to stop the machine and change cylinders at the completion of the toe of every half hose. The needle cylinder is placed in the machine over a binding ring which holds it firmly during the operation of knitting. The needles are lowered into the groove of the cylinder cams by means of a jack cam. The machine is then ready for starting to knit the plain portion of the half hose. The length of the plain portion is

Fig. 2. Diagram of the Foot of a Seamless Stocking.

governed by the pattern chain, the production of the heel, foot, and toe following successively as explained for the regular stocking. The knitting machine does not close the toe entirely making a completed article, but leaves it in a condition where it is only necessary for a looper to join the top part of the toe to the top part of the foot of the stocking or half hose.

As the heel and toe of a stocking or half hose generally wear out quicker than any other portion, they are usually re-inforced by an extra yarn on this machine, which is known as the splicing arrangement, where extra yarn is fed into the machine during the knitting of the heel and toe, said extra yarn being automatically stopped during the knitting of the other portions of the stocking or half hose. During the knitting of this extra yarn, it is necessary to have the stitches made longer to accompany the extra bulk of the yarn, and for this reason a projection on the cylinder drum acts to aid the needle cylinder slightly which produces the desired effect, by raising the sinkers and needles. The fact that the sinkers are thus raised to a higher position and the needles are carried down by the cams to the same lowest position as formerly, causes a longer stitch to be made.

THE PATTERN DRUM.

The various operations required for making the different portions of a stocking or half hose are obtained at the proper time by means of the pattern chain and pattern drum, the pattern chain controlling the movement of the pattern drum, which serves to operate the different mechanisms. The pattern drum is a cylindrical barrel containing nine rows of holes which are used to have screws inserted to hold the plates which operate different mechanisms on the machine. Each row on the pattern drum controls one operation of the machine and the pattern drum is controlled by the pattern chain, since said pattern drum is operated by means of a ratchet and pawl, said pawl being lifted into and out of contact with the ratchet by means of raisers and sinkers on the pattern chain. The pattern drum is only operated when it is desired to change the operation of the machine for making a different portion of the stocking or half hose. Located on the same shaft with the pattern drum are two cams for operating the clutch levers in order to produce continuous rotation of the cam cylinder or reciprocating motion as required. The nine rows of pattern surfaces on the pattern drum are used respectively as follows:

The row at the extreme left outside of the cylinder of the drum is necessary for the production of a longer stitch during the process of knitting the heel and toe, which, as previously explained is necessary to allow for the extra amount of yarn due to the splicing yarn. The action of the cam surface is to actuate a lever which raises the needle cylinder slightly.

The second row, constituting a pattern surface, is used for shaping a stocking, that is, to make the stitch gradually tighter as the ankle is approached. To accomplish this the needle cylinder is raised to first make a comparatively loose stitch, and a gradual lowering of the needle cylinder is brought about to produce a tighter stitch.

The third pattern surface is used for operating the splicing mechanism when the heel and toe are being made.

The fourth row is for the purpose of bringing the lower picks into knitting position during the knitting of the heel and toe.

The fifth row is used in taking the lower picks out of action at the completion of the heel and toe.

The sixth row is used for releasing the take up springs of the feeding arrangement of the splice device, which thus enables the yarn to be fed to the needles.

The seventh row is used in making half hose to stop the machine at the completion of the toe.

The eighth row is for the purpose of giving a "kick off" to the cylinder pattern drum, which moves said drum so that it will be in a proper position to give the required movement to the levers which will bring the take up springs down more quickly.

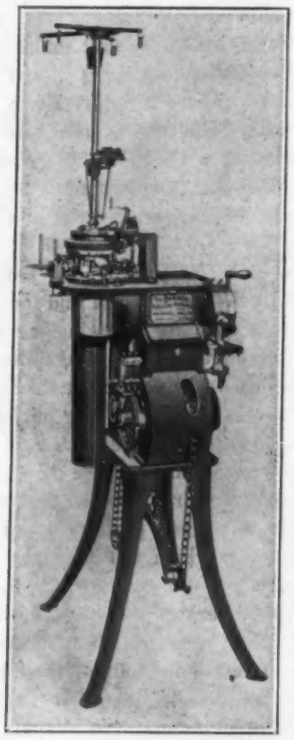
The ninth row operates the bob pin through proper connection, the latter operating the lowering and raising cams 8 and 13 to operate one half of the number of needles out of working position while making the heel and toe, and then again dropping back into position.

THE "BANNER" FULL AUTOMATIC KNITTING MACHINE.

This full automatic latch needle knitting machine as shown in the accompanying illustration is manufactured by the Hemphill Mfg. Co., Pawtucket, R. I. It is designed on the revolving needle cylinder principle, with the cam cylinder and bobbins stationary. It is used for making hosiery, the plain portion of men's half hose and for footing children's ribbed hose. It is claimed that the same operator with similar yarn, can produce nearly or quite as much work on two "Banner" machines, as can be made on three automatic machines of another type. This great production is attained by means of special features embodied in this machine, as follows: The feed of the machine is from twenty-five to thirty per cent. faster; the bobbins are stationary, hence more tender yarn can be knit successfully; the needle cylinder revolves and is perfectly balanced, which prevents friction and enables the machine to run light.

The working parts are so arranged that the operator can adjust the work quickly and with ease. Each thread is run through grooves that are stationary, and the operator can see at a glance when each thread is being run into the fabric. There is an open space between the cylinder and

sinker head through which the lint and waste drop. The sinker ring is self-cleaning,—preventing accumulation—the needles are in plain view and can be removed at any stage of the knitting without removing any part of the machine. The picking device for operating the needles in the production of the heel or toe, is simple and extremely easy on the needles. This machine is built for four changes of yarn, which makes it possible to knit plain work, high spliced and double sole, black leg with white foot, plated with change of yarn at heel and toe, plain work, also plated black leg, with plated white foot, all automatically. It is especially adapted for plated work. The yarn is held in



"Banner" Full Automatic Knitting Machine.

place by a binder which is positive and does not miss on any kind of yarn. If the yarn breaks it does not fly out of the yarn carrier, and yarn of any twist can be used without difficulty.

There is no perceptible vibration when the machine is running at full speed. It is claimed that the cams operating the needles are so arranged that in connection with the needles made especially for this machine, breakage of needles is from twenty-five to fifty per cent. less than on other automatic machines.

The manner of transferring is unique, the transfer being made with one revolution of the cylinder. There is no raising of the cylinder nor adjusting of the cams to place the needles in position before and after transferring. The transfer cup is simple, strong, and durable with removable points. The speed of the machine is about 300 turns per minute.

The management of the Tremont and Suffolk Cotton Mills, Lowell, Mass., has decided to stop 1,500 of the 6,100 looms for an indefinite time. The stoppage of the machinery will mean a curtailment of about 25 per cent. and will affect 700 of the 3,000 operatives.

THE "INVINCIBLE" FULL AUTOMATIC KNITTING MACHINE.

This full automatic latch needle knitting machine is manufactured by the Jenckes Knitting Machine Co., Pawtucket, R. I., and is made on the stationary needle cylinder principle. It is used for making ladies' stockings, half hose, and footing children's ribbed stockings.

The "Invincible" is made either as a bench or stand machine, in quarter inch sizes from 2 to 4¼ inches, inclusive, the diameter being measured from back to back of opposite needles. It is built in all gauges in the foregoing diameters, which will produce a commercial article, from 60 needles in 4¼ inches to as fine as 250 needles in 3¾ and 234 needles in 3½ inches.

The machine is simple in construction, has few parts and consequently but little time is required for the operator to become familiar with it and obtain its maximum production. All working parts are easily reached and all parts are interchangeable. All of the motions are rotary and positive, insuring light running.

When making the heel and toe, the speed of the machine is reduced just before changing from circular to reciprocatory knitting, thus avoiding all shock, and insuring an easy operation of the parts. All gears and movable parts that could injure the operator are covered, and the handle of the machine remains stationary at all times.

Fabric.

The importance of quality in a fabric as a factor in marketing hosiery is becoming more and more recognized, and it is fast becoming paramount. The excellent quality of the "Invincible" latch needle fabric is generally recognized. It is claimed to be more even, more elastic and have a better face than that knit on other machines of this type. The fabric has the appearance of being finer than its gauge, and the wales are straight. The stitch which forms the gore in the heel and toe is very close, even and elastic. Upon examination the fabric shows a decided depth between the wales which gives a "lofty" effect that is so much sought after. This effect can be obtained only where the stitch is not subject to strain. There is no straining of the stitch on the Invincible, and, owing to this fact, menders are of infrequent occurrence, low grade yarns can be used, and most knots and bunches can be knit without cutting.

Fine Gauges.

The Invincible has attained an enviable reputation on extremely fine gauges, and its success is evidenced by the extensive use of the machine in mills making this class of work. The machine is built on principles that make successful knitting on fine gauges possible. Machines are made with as many as 240 needles for 3¾ inches. It is not the mere combination of needles and sinkers, but of an organization of principles peculiar to the Invincible machine.

Self-cleaning Sinker and Frictionless Sinker Heads.

The important part that sinkers play in good knitting is well known. The sinker head in this machine with its patented self-cleaning sinker is so constructed that there can be no accumulation of lint to interfere or limit the movement of the sinkers. Accumulation of lint in the sinker head would cause menders, waste, sinker breakage, loss of production, variation in lengths, streaked stockings, and a generally inferior product. Where lint packs in the sinker head, wear occurs not only on sinkers, sinker cams and

sinker cam rings, but on other parts of the machines, which have to work harder to overcome the consequent friction.

SINKER CAM RING.

It is common to use friction in the form of a spring to control the sinker cam rings. There is absolutely no friction on the Invincible sinker cam ring, a positive-locking device being used. The sinker cam ring is locked in its proper position at all times. No waste or menders are made by the Invincible sinker head.

NEEDLE CYLINDER.

Needle cylinders for this machine that are finer than eleven and one-half needles to one inch are so constructed that a damaged or worn bar can be replaced by simply removing a nut and washer at the bottom of the cylinder, forcing out the damaged bar and slipping another one in its place. This type of cylinder is known as the sectional cylinder, and is indestructible. It permits the use of a finer grade of steel than can be obtained in a cut cylinder. The grain of the metal runs lengthwise of the bar, thus insuring a very smooth surface for the needle to work on, and reducing the liability of the bars becoming nicked and dented.

The bars also possess more spring and pliability than is

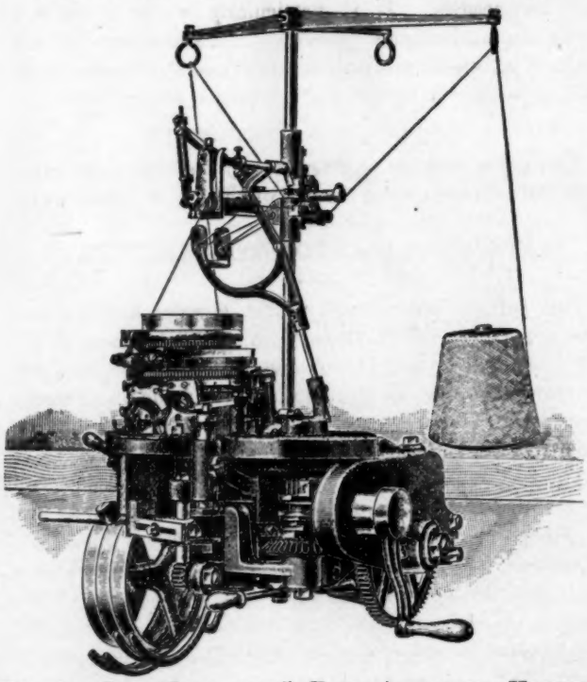


Fig. 1. The "Invincible" Full Automatic Knitting Machine.

possible in a cut cylinder. Punching of needles owing to bent bars is much less liable to occur, with a consequent lessening of liability of needle butt breakage, and wearing of cams and needles through undue friction. The necessity of replacing a bar is of rare occurrence.

CHANGE OF GAUGE AND DIAMETER.

Ordinary changes of gauge are accomplished by changing the needle cylinder only, which is done by simply releasing the cylinder from the clamp, which holds it rigid in the machine, and setting the desired cylinder in its place. When extreme changes of gauge are desired, it is, of course, necessary to change a few cams in the cam head or cylinder.

A change of diameter of the cylinder is effected by changing the cam cylinder, needle cylinder and needle cylinder clamp. Any of the above changes require but a few minutes, as all parts are standard and interchangeable.

TRANSFERRING OF RIBBED TOPS.

The sinkers in this machine are used to center the quill ring. The needles are leveled below the sinkers, out of sight, so that the quills do not come in contact with them until placed between the sinkers, which hold the quills in perfect alignment with the needles. It will readily be seen that the needles must enter the quills when raised to receive the loops. No skill is required to transfer by this method.

PATTERN AND FASHIONING MECHANISM.

The pattern chain is composed of detachable links, so that any desired change can be made by an ordinary operative, while the machine is in motion. One loose course is provided as a guide for looping, and another as a guide for cutting off on ladies' stockings. The stitch or tension can be regulated independently for the leg, foot, ankle, heel and toe. The stitch in the heel and toe is automatically loosened to accommodate the reinforcing thread. A change of stitch can be made in any part of the stocking while the machine is in motion.

The fashioning mechanism is easily arranged to provide for an extra loosening of the stitch at the top of ladies' stockings, when it is desired to make an extremely elastic welt. The mechanism for regulating the automatic change of stitch which fashions the leg and ankle in ladies' hose is positive and self-setting.

ATTACHMENTS.

All of the Invincible attachments are self-contained and independent of the machine proper. The ease with which an attachment can be applied to this machine is important. Any one of the attachments can be applied in the knitting mill, without important changes on the machines themselves or the drilling of holes.

REINFORCING ATTACHMENTS.

Owing to the rapidly increasing use of mercerized lisle and linen yarns in splicing, two reinforcing attachments have recently been perfected which will meet all requirements, and each of which positively delivers the reinforcing yarn to the needles on the first courses of the heel and toe. These two attachments are of especial interest to manufacturers of guaranteed hosiery and users of mercerized silk and linen yarns.

19C REINFORCING ATTACHMENT.

This attachment is of the twister type, the reinforcing yarn being carried to the needles by a close spinning of the reinforcing yarn on the regular yarn. The reinforcing yarn is spun on the regular yarn so tightly that there is no slipping of one yarn on the other.

As the speed of the Invincible machine is reduced just before beginning the heel and toe, at which time the twisting operation occurs, a very close twisting together of the yarns will result, as the regular yarn is traveling slowly, and the twisting operation is a very rapid one. Enough slack yarn is held so that no yarn is drawn from the cone or bobbin until the reinforcing yarn has reached the bobbin needles. This, combined with the close double wind, makes it absolutely certain that the reinforcing yarn will reach the needles at the proper time. The yarn is cut off at the completion of the toe and heel, and is held firmly in the jaws of the attachment when not in use.

It is obvious that reinforcing yarns of widely varying character require different handling to secure uniform success. This attachment is provided with adjustments governing the amount of tension put on the yarn during the twisting operation and the time of release of the end of said yarn at the time the twisting operation occurs. The end of the reinforcing yarn is released when the twisting operation occurs, by the positive opening of a pair of jaws, and therefore neither it nor the regular yarn is subject to any strain from the attachment. The closeness of contact of the regular and reinforcing yarns can be so regulated that slippery, wiry or soft yarns of any description, single or ply, can be fed with certainty.

17C REINFORCED ATTACHMENT.

This other attachment is especially designed for use in extreme cases, where it is desired to reinforce with several ends of stiff, heavy, hard twisted yarns. It is, however, just as adaptable to conditions where the slightest single end is used. In fact, whatever material—linen, silk or mercerized cotton—and whether ply or single yarns, from the very lightest to several ends, is used, this attachment handles it with equal facility.

By this method the yarn used in reinforcing does not come into contact with the regular yarn at all. The yarn is carried to the needles and held by a pair of jaws until it has been knit by several needles. The yarn is then released by the automatic opening of the jaws, which then assume their normal positions to receive the reinforcing yarns at the completion of the heel or toe, cutting it off and holding it free from contact with the fabric until it is to be used again.

18C HIGH SPLICED HEEL AND DOUBLE SOLE.

A very simple, almost noiseless attachment, without any pivotal motions, is used for this purpose, being known as 18C. The reinforcing finger slides in a fixed plane. The cams which operate the finger have very easy angles, eliminating noise and wear. The splicing is positively introduced and taken out on the same needle. No gap is made between the splicing and the heel and toe. The splicing is positively put in every course where required.

3C YARN CHANGER—COARSE GAUGE.

By this method of automatically changing yarn, without the revolving of bobbins, the objection to heavy bobbins or cones is removed. The yarn is fed from stationary packages of any size or description, and any number of ends may be used. No part of this attachment is mounted on the cam ring, or yarn carrier ring, consequently no part of it revolves.

This attachment permits the making of stockings on coarse gauges with the heel or toe or both of different color, and can be arranged to make the foot of a different color, and at the same time reinforce the toe and heel; also to make a stripe or welt of a different color at the top of the stocking, by the addition of the 5C reinforcing and white welt attachment.

6C PLATING ATTACHMENT.

Several styles of plating attachments are made by this firm to meet the varied demand. All of the plating attachments put the plating thread on one face of the fabric all of the time. For coarse gauges a plating attachment, No. 6C, is made without revolving bobbins. This permits the use of large yarn packages, thereby saving the cost of winding on special small bobbins, and reducing the chance of run-offs and consequent waste. This attachment is extremely simple, and has no parts subject to wear.

11C PLATING ATTACHMENT.

This attachment makes a plated stocking, and differs from the 6C attachment in that the plating yarn is mounted on the cam ring. It makes the same stocking as the 6C attachment, and is used with 2C reinforcing attachment only, which reinforces the heel and toe. For fine gauges a revolving bobbin type of plater is used, which permits a change of yarn in the heel and toe; this plated is also used where it is desired to reinforce the heel and toe and not change the yarn.

10C STRIPING ATTACHMENT.

This is a striper which is simple in construction and positive in operation. A change in the design is quickly made, and a design need not be repeated in a stocking. This attachment is used in connection with the 2C reinforcing attachment, and can be used as a yarn changer, when desired, to make stockings with heel and toe of different color, or white feet.

13C FABRIC TAKE-UP ATTACHMENT.

This attachment puts a tension on the fabric as it comes from the needles. It is particularly valuable on fine gauges, and all machines finer than 17 needles per inch are regularly equipped with it. It is very sensitive and exerts at all times an even self-regulating tension on the fabric.

14C GARTER TOP ATTACHMENT.

This is for making a garter top on a stocking by introducing an extra thread at the top of the leg of ladies' hose.

MAYO'S FULL AUTOMATIC KNITTER.

This full automatic, latch needle, circular knitting machine is made by Geo. D. Mayo Machine Co., Laconia, N. H., and is used for making ladies' hose, half hose, and the footings for children's rib stockings. It is made in different sizes from 2¼ inches to 4 inches. The needle cylinder is stationary, while the cam ring revolves.

The features in the new model shown in the accompanying illustration that are of interest to manufacturers, are its extreme simplicity, strength of construction, durability, high speed, and quickness of operation. The ease with which unskilled help can learn to run it is a decided advantage. It is claimed that these combinations make it the most productive and economical knitting machine in operation.

It has less parts than any other full automatic knitter.

The main frame is cast in one piece, which makes it rigid, strong and compact, and at the same time eliminates unnecessary weight. The gears are made with coarse teeth and wide face, and all parts subject to wear or strain are extra heavy and strong. The change from circular to reciprocating motion, or the reverse, is positive, and made without shock or jar. The speed is controlled independently of the clutch, and is cut down just before the clutch is shifted for reciprocating, and increased immediately after it is shifted back for circular knitting. The clutch and other motions do not rely upon springs to make them operative.

The needle-operating cams consist of but one stitch-forming cam which operates the needles, while making the heel and toe, and consequently a uniform stitch is obtained

when reciprocating the cam ring. The stitch cam can also be taken off and returned to its place without removing the needle cylinder or cam ring, or disturbing the work on the needles.

All guides and auxiliary cams are entirely eliminated, so it is impossible to bend or break needles, or stick the cam ring. In fact, the motion of the machine can be reversed with all the needles in operation. The needle butts are in sight at all times. The needle-picking devices are simple, and work easily on the needles. They are mounted inde-

Mayo's Full Automatic Knitter.

pendently of the cam ring, and can be removed without disturbing other parts of the head.

The construction of the sinker head is such that it is impossible for dirt or lint to collect in the grooves, consequently it is self-cleaning. The annoyance, expense and loss of production caused by the necessity of cleaning sinker heads and cylinders is thus avoided. The regular Mayo needle is used in this machine in connection with the skeleton cylinder. The latter, however, instead of having soft metal cast on the bars to hold them in place, is built up and secured permanently in the bed plate in such a manner that any of the bars can be removed and replaced in a moment without removing the cylinder.

The device for introducing a splicing thread into the heel and toe is novel and absolutely sure in operation, with any kind of difficult material, such as hard twisted lisle thread, mercerized cotton, or silk. It does not rely upon frictional contact by bringing the threads together, or winding one about the other, but with a simple mechanism the thread to be introduced is securely knotted upon the running thread or threads, and is certain to go in every time.

All timing adjustments of the different parts of this machine are made at the shop. If the machine is taken apart for any reason, the parts can not be put together in any other than their proper positions. No set screw adjustments are used.

The pattern mechanism is very simple, and an operator can make the necessary changes from hose to half hose, or footing, in a moment. There are no gears or dials whatever connected with the mechanism. It consists of a short chain with special links, and is not over two feet in length for the longest stocking. All adjustments are made, and all parts of the machine are readily accessible from the front; consequently they can be placed close together or back to back to save floor and shaft space.

The length of stitch may be changed automatically at any part of the hose, and to any extent desired. Independent adjustments are provided for the hem, leg, ankle, heel and toe, and foot. An adjustable loose course is put in at the finish of the toe for looping. The transfer cup is made with removable points, and operation of transferring ribbed legs or tops is quickly and easily accomplished.

Automatic attachments may be added for making a complete change of yarn in the heel and toe, plating, tipping, lace front, high spliced heel and double sole, garter top, two color stripes, combination stripes and lace, etc.

PAXTON AND O'NEILL'S FULL AUTOMATIC HOSIERY MACHINE.

Paxton and O'Neill, 541 North Third St., Philadelphia, Pa., manufacture a number of latch needle circular knitting machines as follows:

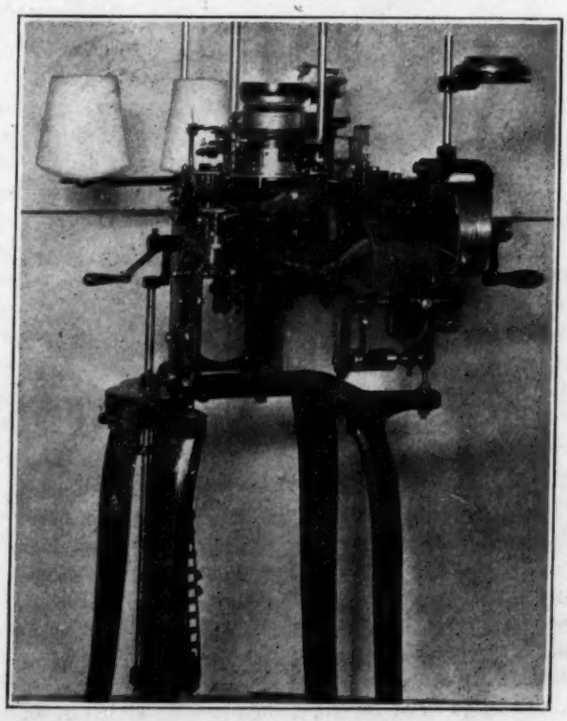
Full automatic knitter for making hose and half-hose, in cotton, wool, linen or silk. This machine is made in all gauges, the finest being a specialty. They are made with garter top, high spliced heel and double sole attachments, (with or without crow-foot effect), a length measuring device and a yarn changer.

Full automatic lace machine for boot pattern.

Full automatic legger and heeler for full-fashioned hose blanks.

Necktie and muffler machines.

Three-fourth automatic, for split sole hose and half-hose, in cotton, or cotton and wool, linen and silk.



Paxton & O'Neill's Full Automatic Machine.

The Paxton and O'Neill full automatic hosiery machine, traced back through its various devices, shows an orderly growth and development from the hand-power machine in use in 1885, when this firm started in business. This company has made numerous improvements on this machine, among them being the weldless wrought steel cylinder now in general use in both seamless and rib knitters, which has made it possible for seamless knitters to compete with Cotton's patent full-fashioned frames for a large and steadily increasing share of the trade in the finer lines. When the trade called for automatic knitting, Paxton and O'Neill

Samples from Paxton & O'Neill's Knitter.

made their half automatic attachment, which increased production about 50 per cent and improved the quality of the work. At this time their needle picker was invented, which although not the first to be used, was considered the best, and is now used for 240 and 260-needle work, and is still considered by some to be the best in use. The firm's half automatic attachment was succeeded by the three-quarter automatic machine having an elastic sinker, which was a development of an earlier invention for the hand knitter, and which is still in use, and meets the most exacting demands on the finest fabrics.

The first 240-needle stocking machines were made in 1901 for a knitter who first used a pair of cylinders as an experiment, and then ordered fifty of the machines, which, with the wrought steel cylinders, pickers and sinkers, were a success from the start, and at a time when 200-needles was the maximum of any other latch needle machine. Three-quarter automatic boot pattern lace and split sole machines were also made, and it is claimed that the latter is still the only good split sole machine on the market.

In 1903 the hosiery machine was made full automatic, retaining the approved pickers, sinkers and cam system, combined with the additions necessary in a smooth running, easily operated, and eminently satisfactory machine. In 1904, when fine mercerized gauze was called for, the machine was adapted to carry the cone of splicing yarn for the garter top, heel and toe, so that the yarn could not fail to go in at the right time as long as it ran off of the cone.

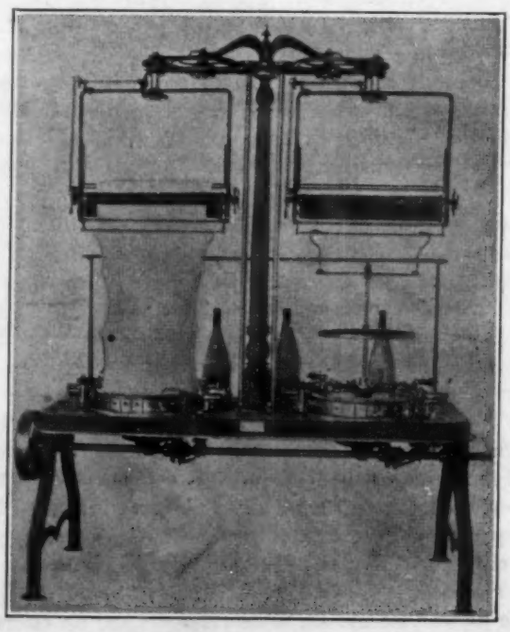
Other changes and additions have been made from time to time as required, so that it is now up-to-date, for making some of the finest goods on the market. The machine is simple, durable and easily cared for, with the parts readily accessible for adjustment or repair. Its method for transferring rib tops is one of the best. Its length measuring device, on which this firm was granted the patent as the original inventors, after interference proceedings in the Patent Office with two prominent knitting machine builders, gives practically uniform length in ladies' hose, saving the trouble and loss caused by variation in length due to uneven yarn, when measured by the number of courses knit, as had been done on all full automatics previously. Though the machine is adapted to all gauges, its superiority shows especially in the finer makes, using mercerized, linen or silk yarn and making them with or without garter top, double sole, and crow-foot stitch in the foot. A yarn changer and plating machine attachments, may be had on the machine when desired.

The full automatic lace machine has a wide range of designs in boot pattern lace hose, and like all of the machines made by this firm, makes a good production with a minimum of bad work. The full automatic legger and heeler for full-fashioned hose does the work of two high-priced spring needle machines, with a large saving both in investment and cost of production, while the goods are equally satisfactory, the stocking being finished on the regular full-fashioned footer.

CRANE'S SPRING NEEDLE KNITTING MACHINES.

The Crane Mfg. Co., Lakeport, N. H., manufactures knitting machines of various styles and sizes, but particular attention is directed to the improved two-head spring needle underwear machine shown in the accompanying illustration, which is used in the production of balbriggan underwear.

The machines made by this concern are in sizes from 2¼ and 40 inches in diameter, for the production of a great variety of fabrics. Most of the machines, however, range in



Crane's Two-Head Spring Needle Underwear Machine.

size from 13 to 30 inches in diameter. The sizes from 13 to 23 inches are largely used for the production of plain underwear. The sizes between 22 and 30 inches are used for a great variety of fabrics, including rubber linings, athletic goods, bathing suits, etc. To these machines, aside from the plain feeds, there can be applied feeds for the production of eider down, stockinet, and astrakhan fabrics. They are made with any desired gauge and equipped with any number of feeds according to the circumference of the cylinders. They are built in a thorough and workmanlike manner and many of them are in use in the leading mills of the country.

The machines are all fitted with trick tops for the needles, which are claimed to be superior to the leaded needles. The bur blades are made with interchangeable hardened blades in a variety of sizes and shapes to suit the requirements of the operator.

SPRING NEEDLE RIB FRAME.

The accompanying improved spring needle rib frame is made in sizes from 13 to 21 inches in diameter, which is especially designed to produce a fine grade of underwear equal, it is claimed, to the best domestic or imported fabric. While this machine is of more recent invention than the other machines, quite a number of them are in operation in mills producing high grade fabrics. In construction the machine is modeled after the cylinder and dial type, and so constructed that the working parts are accessible and easy to inspect or adjust; while the number and complexity of these parts are reduced as much as possible, the efficiency is increased. The machines are made in ranges from 18 to 8 needles. Aside from the above sizes, they have been made in smaller sizes for the production of infants' and children's goods.

Both 1 and 1 and 2 and 2 rib fabric machines are made.

AUTOMATIC LATCH NEEDLE MACHINES.

Automatic latch needle toque machines are made in sizes from 5 to 7 inches inclusive, of any desired gauge, these measurements being from back to back of the cylinder needles. They are equippel with either 1 or 2 feeds as desired, and each feed has an automatic striping attachment for two colors when desired. They have sectional cam rings with cams so arranged that they can be placed and replaced as occasion may require with very little loss of time. They have friction pulleys.

Aside from toques the machines are used for children's shields or leggings. Machines of this type, but of smaller diameter, are used for knitting ribbed tops, shirt cuffs, drawer bottoms, also for ladies', misses' and children's hose legs welt, loose coarse and striping. This style machine of the larger diameter will produce jackets, sweaters, and ladies' and misses' and children's plain ribbed and fancy ribbed underwear. These machines are arranged so that the fancy tucked stitch if required can be knit, and then changed automatically to the 1 and 1 stitch, thus giving the garment the proper shape. It is claimed that these machines have one of the best yarn striping attachments ever used, leaving no ends to show where the splicing is made on either side of the fabric. The simplicity of the construction of the machine is one of the essential features, being easily changed to make the different kinds and patterns of work required.

STRIPING MACHINES.

The improved automatic latch needle 3-colored plain striper machines are made in sizes from 7⅝ to 14⅝ inches, inclusive, of any desired gauge. Aside from knitting the three colors they can be arranged to knit two colors or the plain stitch on the same machine. These machines are used for the production of bathing suits, theatrical and athletic goods.

STOP MOTIONS.

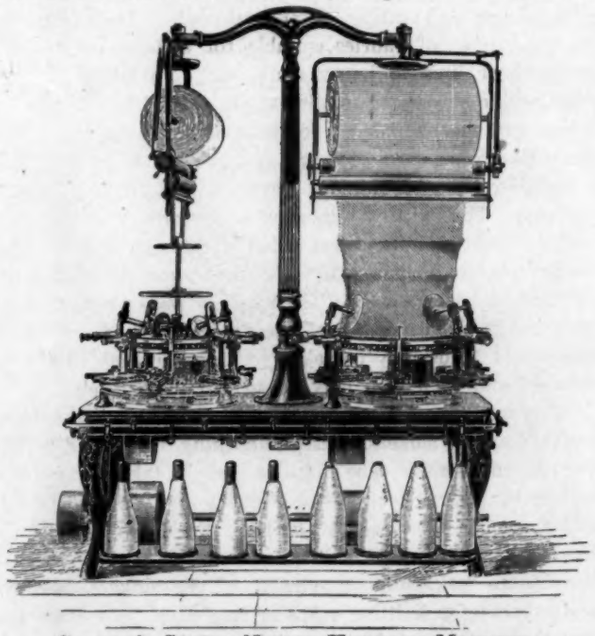
The Crawford stop-motion can be applied when desired on all the circular machines except the 2-head spring needle underwear machine, and for this latter machine there is a special stop-motion. The company also has stop-motions of its own make, for all of its machines.

The one-section flat frame machine is made in several sizes, producing a fabric equal to hand frame work. It is made of any desired gauge and when required is fitted with automatic striping attachments for two colors, also with tuck, welt, loose course, drawn thread and shogging attachments. A great variety of work can be made on this frame, such as twisters, with fancy welts and stripes, sleeves with royal rib, changing to 1 and 1 stitch at the cuff and binding it with a welt. They are also used for the production of ladies' mitts and fancy mitten wrists, shirt cuffs, with one or two colors. On certain sizes ladies', misses' and children's underwear is produced.

Owing to the death of the late president, J. S. Crane, last January, the following officers have been elected: C. H. Perkins, Pres. and Mgr.; B. J. Smith, Vice-Pres. and Gen. Foreman; H. R. Young, Treas.

GORMLY'S SPRING NEEDLE KNITTING MACHINE.

The accompanying illustration shows a 2-cylinder spring needle knitting machine manufactured by Robt. W. Gormly & Co., Troy, N. Y. These machines are made in different sizes from 11 inches to 32 inches, for plain knit underwear.



GORMLY'S SPRING NEEDLE KNITTING MACHINE.

The standard machine made by the company has two cylinders to each table and is equipped with four feeds to each cylinder. Each cylinder on the machine shown in the illustration is driven independently of the other, the loose pulley system or the friction pulley arrangement being used as

may be desired. The illustration shows the tight and loose pulley arrangements, the pulleys being located under the machine table.

For fleece-lined work the standard size of this machine will take any size up to 55 inches, swinging a 38-inch take-up. This machine will produce from 90 to 165 pounds per day, depending upon the speed of the machine. Various kinds of work may be produced by the use of special parts on the machine. All gears are cut, and consequently run with practically no noise.

The machine is equipped with a patented feed stand circle and links, allowing universal adjustment in any direction for all parts. The circle may be used with any size of cylinder up to 30 inches. In addition to the standard size of table, a medium table is also made, which will swing a 46-inch take-up, and if built with the double column it will swing a 54-inch take-up, which will take cloth from a 35-inch cylinder. An extra long and heavy table is also built for a 35-inch cylinder used in making buffalo robes, blankets, coatings, etc. A complete two-head machine has two cylinders of any size up to 25 inches in diameter, four feeds of any gauge, a stop motion to each cylinder, and all necessary parts. It is stated that this machine as now constructed is the result of forty years of practical experience and the company is said to be the oldest manufacturers in the business now making this style of machine. Some of the more important patents on the different parts of the machines back as far as 1875.

WILCOMB'S SPRING NEEDLE WEB KNITTING MACHINE.

The accompanying illustration shows a spring needle knitting machine manufactured by the Wilcomb Machine Co., Norristown, Pa., which embodies the well known European sinker and spring needle principle. It is used in the production of fabrics suitable for underwear, stockinette, rubber linings, jersey cloth, etc. The diameters of the machine across the needles varies from 10 inches to 36 inches and the number of feeds from six to twenty. The machines are made of different gauges from 15 to 36. The principle of this machine is distinctive, as no burr wheels are used. The knitting operation is performed with spring needles, sinkers, and eveners that divide the loops. The needles require no truing up. Even stitches are made with no tight and loose wales. The machine works equally well with one feed or with all of the feeds in operation. Any number of feeds may be taken out of operation in a few seconds, and each feed may be adjusted separately.

The relative working positions of the operating devices for the needles, sinkers, presser, knocking over and dividing are non-adjustable. The machine may be taken apart and reassembled by a fixer without affecting a single adjustment, and from the first row of knitting the fabric is exactly like that made before taking the machine apart. It is possible to make one adjustment of the sinkers, needles, and eveners for knitting more or less yarn. No other adjustments are needed or possible. Holes and "run-offs" do not damage the needles, sinkers or other parts of the machine. In the event of holes several inches across, or complete "run-offs," "picking-on" or "setting-up," the work by hand is done away with. All that is required is to put yarn in the thread carrier, apply the power; and good rows of knitting are produced at once.

Either the Wildman or Crawford Stop motions may be had. Thousands of both types are in use, and either one stops the machine before damage is done to the fabrics by reason of defective yarn or winding. A take-up is used which will automatically take varying thicknesses of fabrics producing a uniform pull on the fabric coming from the needles. An automatic winding roll adjustable for

Wilcomb's Spring Needle Web Knitting Machine.

tight or loose wind of fabric is also provided. The take-up and roll are each independently operated, each having one adjustment. It is not necessary to use a take-up roll to make a good fabric on this machine, as it knits equally well without weight or take-up on the fabric. The take-up and roll make the fabric uniform in width and stretch, to suit the condition of cutting to patterns.

All important rotary parts of the knitting head run in a bath of oil. Needles and jacks may be slushed with vaseline or heavy oil without danger of grease streaks in the fabric.

Original improvements of great importance to machines of larger diameter provide for expansion due to frictional heat. Therefore, this machine does not "choke" or become "stuck" from these causes.

Legitimate "hedging" against obligations is based upon precisely the same principle as fire insurance, and is just as sound in morals and business, because in the one case, if there is a heavy fluctuation in the price, the "hedging" contract protects the seller, and in the other, if there is a destructive fire, the "hedging" contract for insurance protects the owner.

BRINTON'S AUTOMATIC RIB KNITTING MACHINE.

This machine, an illustration of which is given in Fig. 1, is used for making ribbed tops for half hose and legs for children's and misses' ribbed hose. This machine is a single feed automatic ribber, with welt and slack course attachments. As explained in the article on "The Principles of Knitting," two sets of knitting needles are required to produce a ribbed fabric and, therefore, this machine is made with two sets of needles, namely, the cylinder needles, which work vertically in the needle cylinder, and the dial needles, which work horizontally in the needle dial. The needle cylinder and needle dial are stationary in the machine, the respective sets of needls being operated by the needle cylinder cams, and the dial cap cams. The two

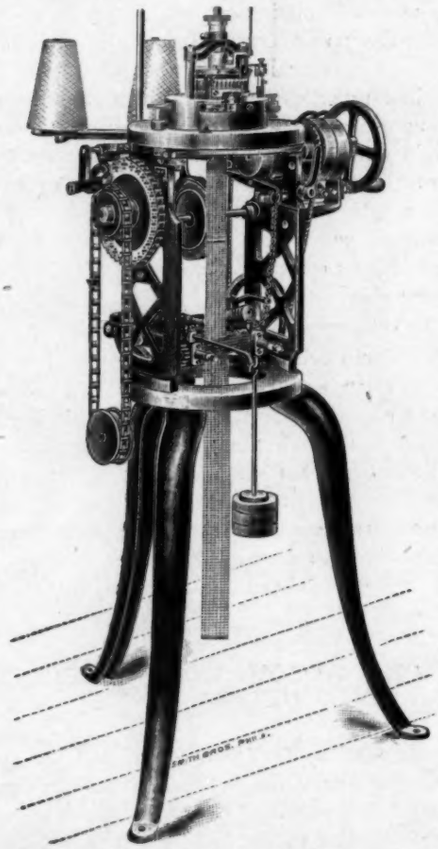


Fig. 1. Brinton's Automatic Rib Knitting Machine.

sets of needles work in conjunction with each other, the dial needles when in their extreme outward position working in the space between the cylinder needles. Similarly the cylinder needles work in the spaces between the dial needles. In the use of ribbed top, and ribbed sleeves for underwear, one end of the same is generally to be attached to the garment while the other end forms a finished portion. For this reason it is necessary in knitting the ribbed top or sleeve to provide for these two conditions. For this reason the slack course and welt are used. The slack course is simply a long stitch to form one end of the fabric, so that the loops may be easily placed on other needles either for a continuation of the knitting process, or of attaching. The welt may be defined as a knit selvage, which will not ravel and is used to finish off that end of the ribbed portion. The welt is made by having the dial needles inoperative for a certain number of courses, while the cylinder needles continue the regular stitch, the dial needles finally making the regular stitch, which thus encloses all of the skipped stitches and forms a kind of cord effect.

The method of operating the machine is as follows: The cylinder needles are operated by the cylinder needle cams in a similar manner to that explained for the plain

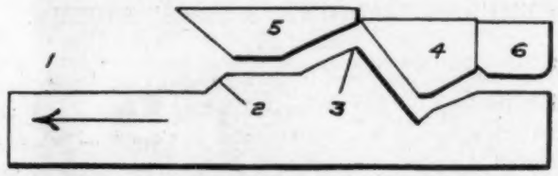


Fig. 2. Diagram of Brinton's Cam Cylinder and Cams.

knitting machine, although the cam arrangement in the rib machine is very much simpler owing to the fact that the cam cylinder has only continuous revolution in one direction. A development of the cam cylinder showing the cams is shown in Fig. 2. The cam 1 is the resting portion at which the cylinder needles are stationary. The portion 2 of the cam starts the needles upwardly and at the point 3 they are in their highest position with the latch open and the previous loop of yarn resting below said latch. At this point yarn is deposited on the projecting dial needles and as the cam 4 begins to act upon the cylinder needles, they move downwardly, catching the yarn in their hooks. The continued downward movement of each needle causes the previous loop of yarn to close the latch and be finally cast off at the lowest point of the cam 4. The needle then rises to its resting position on the cam 1. The cams 5 and 6 are used to prevent the needles from flying out of the machine.

OPERATION OF DIAL NEEDLES.

The operation of the dial needles by the dial cap cam which revolves at the same speed with the cylinder cam, is shown by means of the illustration, Fig. 3. Referring to the illustration, the butts of the dial needles rest in the cam groove, and while resting against the portion of the came A from 1 to 2, the needles are stationary. By the continued revolution of the dial cap cam the needle is

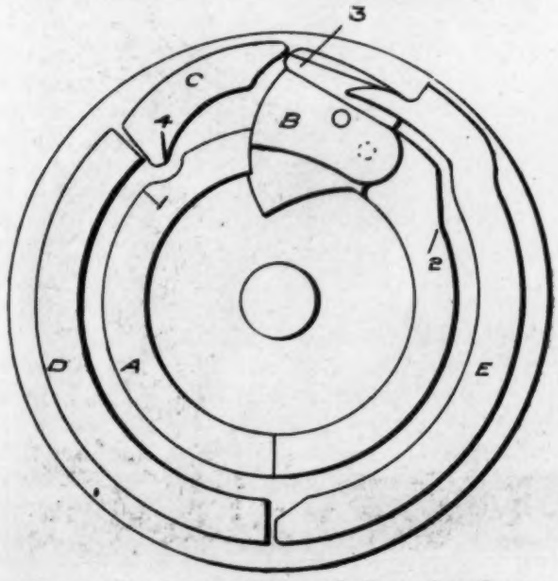
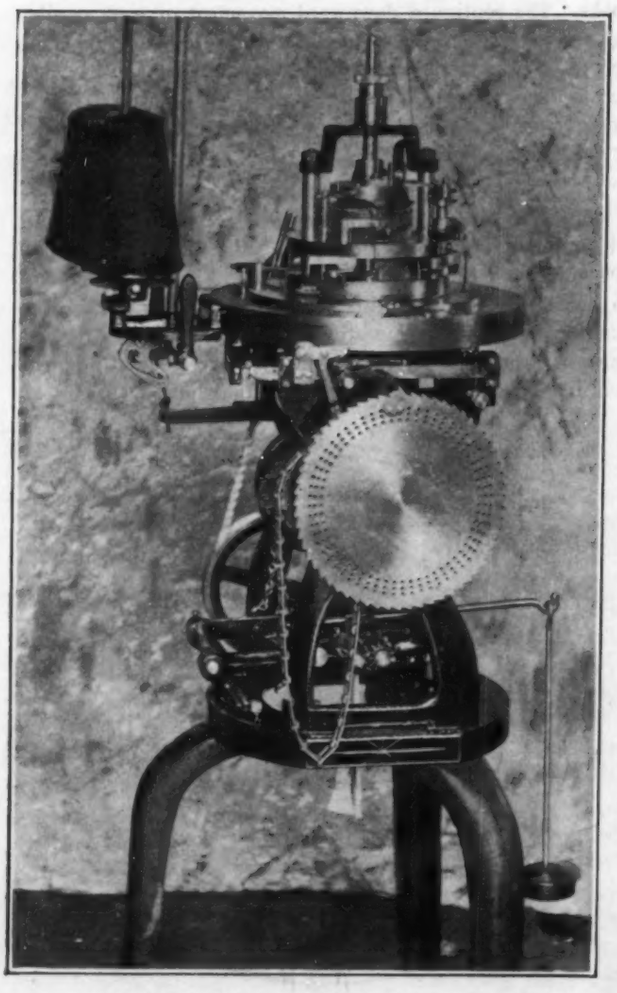


Fig. 3. Diagram of Brinton's Dial Cap Cams.

gradually moved outwardly from the point 2 to point 3, at the latter point the needle being at its extreme outward position, that is, with the latch open and ready to receive the yarn from the yarn carrier. The cam C then acts upon the butt of the needle to draw it inwardly, thus having the loop of the needle to close the latch and be cast off at point 4.

GENERAL MACHINE WORKS' RIBBER.

This machine, as shown in the accompanying illustration, is manufactured by the General Machine Works, of York, Pa., which company was incorporated in October, 1908, and purchased the plant and business of the Ruth Machine Co. The ribber is used for making ribbed tops for half hose, ladies' ribbed hose, boys' double knee hose, sleeves, glove tops, and lumbermen's woolen socks. Special machines are also built for knitting fancy lace patterns. The machine is made in different diameters, ranging from 2¾ to 5¼ inches, measuring from back to back of the opposite needles. One of the important features of this machine is the pattern wheel device which is characterized by its simplicity, durability, and easy adjustment. During the past year the ribber has been redesigned and improved. The ribber can be equipped with various attachments, such as a splicer, single and double feed tuck stitch, etc., which are entirely automatic and such attachments after being adjusted can be brought into use without stopping the machine or making any other changes whatever.



General Machine Works' Ribber.

SPLICING ATTACHMENT.

The patented splicing attachment for making or reinforcing double knees and heels, is constructed so as to make an absolutely certain joining of the reinforcing yarn to the main yarn, when the attachment is brought into operation. The splicing arrangement works equally well with all weights of yarns, the splicer adjusting itself to any thickness of yarn under operation. The splicing attachment will splice all the way around or half way as desired. The elasticity of the product of this ribber is one of its most valuable features which is attained by reason of the great depth of the rib and the new arrangement of the cylinder and dial cams.

The automatic yarn stop motion is another important feature of the machine and is adapted to operate in case a knot occurs in the yarn. The stop motion is made light in weight, simple in construction and is not affected by grease and lint in its proper operation. It will stop the ribber without the necessity of cutting the thread. In the case of a knot or tight wound bobbin, the ribber is stopped, leaving enough thread to start again without knotting or splicing, saving not only time but yarn. It is claimed that this stop motion is the best device of this kind ever put on the market. It is fully protected by patents. All of the parts are interchangeable.

AUTOMATIC LACE ATTACHMENT.

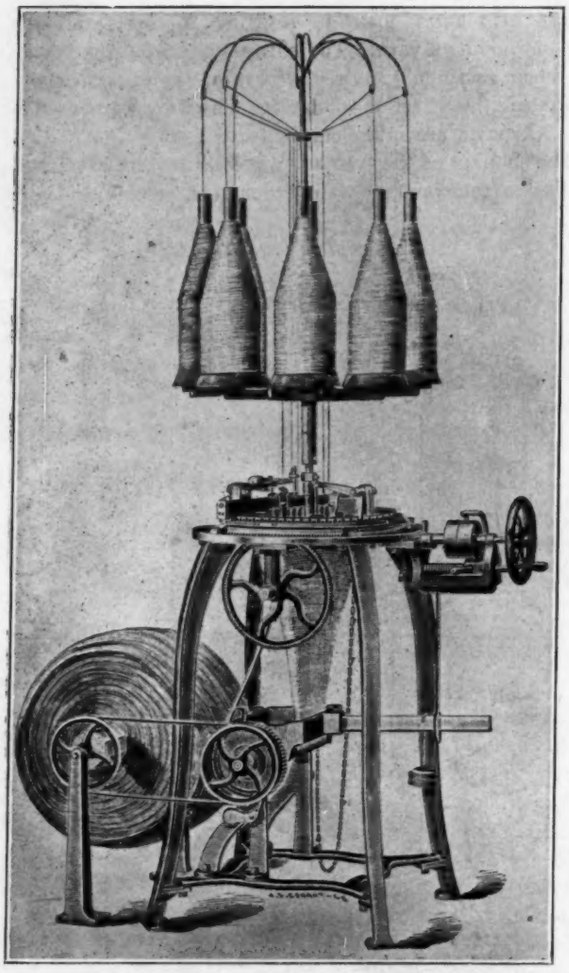
The lacing device will produce a variety of lace effects by a system of interchangeable pattern blocks, the changing of the pattern requiring but a few moments. It is claimed that the ribber is the only machine that will produce the French welt effect in a perfectly round welt. Other advantages claimed are high production, simplicity of construction, improved arrangement of a smooth cam movement, which permits the operation of the ribber without injury or strain to the needles, and the excellent quality of the fabric produced.

LEIGHTON'S AUTOMATIC KNITTING MACHINES.

The Leighton Machine Co., Manchester, N. H., is the sole maker of what is termed the flat head power circular knitting machines, under patent of Geo. A. Leighton and others, for making ribbed knit goods, fashioned cardigan, half cardigan or royal fancy and plain rib and finished or racked edges, perfect welts, or continuous automatically racked webs.

The machines for knitting bodies of garments are provided with as many feeds as its size will admit. Sizes under 9 inches are fitted with 4 and 6 feeds; up to 14 inches 8 feeds are used; above 14 inches, 14 to 16 feeds are used.

Latch needles are used, and the machines are built with stationary needle cylinders and dials. A feature is that the knitted fabric passes down over the exterior of the cylinder, as the dial needles are operated outside of the cylinder, with the latches toward the center of the machine, instead of from the center outward to the edge of the cylinder. This method enables the use of cams with easy bevels, and the drawing of yarns into stitches with very little strain on the stock, each stitch being formed almost completely before a second stitch is drawn from the yarn, in this respect resembling the operation of the spring needle machine in forming



Leighton's Automatic Knitting Machine.

its stitches. This gives the machine a greater range in knitting good fabrics from heavy as well as fine yarns in the same machine. This also enables the operator to have full view of the goods as soon as it is formed by the needles, and to know at all times just what kind of work the machine is knitting, thus saving waste in knitting new samples, trying new combinations of yarn, and in detecting and remedying imperfections.

All rib machines require that where the dial and cylinder needles cross each other they must not touch, but be at an equal distance from one to another. This adjustment is obtained in these machines by dogs, adjusted by screws, through which the web passes, in full view of the operator. The web need not be cut to adjust them, obviating the necessity of guessing as to their exact position. As neither the cylinder nor take-up revolves, the fabric can be examined at any time, taken away from the machine, or rolled up to be taken away as desired. The yoke that sustains the needle cylinder is fastened direct to the cam plate, and always runs true with the other parts of the machine.

Each set of dial cams is independent of the others, and any one or all of them can be made to change from tucking to plain stitch automatically, as desired. The cams are on segments, so constructed that they can be removed at any time without taking the machine apart.

The needle is of special construction and so made that the butt is in view and the needle can be removed at any position of the machine without removing the key or blocks to get at it. Thus a broken or poor needle may be removed without taking the machine apart. The machines are provided with weighted take-ups, the weights being hung on weighted scale beams, producing as fine an adjustment of weights as can be obtained, and not dependent on springs. An oil cup under the cylinder prevents the goods being soiled. In case a needle breaks or fails to work properly, an automatic stop motion prevents any damage by stopping the machine. An automatic thread stop-motion is provided for each thread and in case an end breaks or bobbin is emptied on the machine it prevents running off the work. Automatic and adjustable brakes also aid in the easy stopping of the machine whenever the stop-motions are called into play. Latch openers for the needles are provided, which prevent drop stitches, and aid in setting up the work.

The sizes of machines are determined by the kind and style of goods to be made, and it is claimed that there is no machine made that admits of as great a range in size of yarn; for instance, No. 6s to 20s cotton can be used with equal facility on the same machinery. This enables manufacturers to make a great variety of styles and weights of goods on the same machine, which is very desirable. They are made one-fourth smaller to produce the same size and weight of goods made on other machines. Cylinders and needle plates of different gauges may be used in same machines.

The usual number of cylinder needles for underwear is eight to ten per inch. Ten needles to the inch has many advantages for ladies' underwear, in that they can be used to knit either 1 and 1, 2 and 2, 4 and 2, 6 and 2 rib, or any combination of fancy ribs used on light weight goods. Four to seven needles to the inch are usually used on sweater and cardigan jacket work.

All of the Leighton machines will not only produce goods with one face wool and the other cotton, but will also knit perfectly plated goods that is both surfaces wool, while the center is of cotton, in any combination; and will knit goods with a silk or worsted face on one side with cotton on the other while using but 20 per cent. of worsted or silk.

COLLARETTES, RIB TAILS, CUFFS AND ANKLETS.

The Leighton Company also makes machines for collarettes with or without stripes, and racking or shogged stitches, for ornament, also rib tails for shirts, both plain or with a stripe. The stripes can be put in any part of the ribs. Machines are made for cuffs and anklets in any size and gauge desired, with welts and royal rib. These machines are being used to make ribs for coarse goods as well as to put on balbriggan goods.

ARTIFICIAL SILK.

The growing importance of artificial silk in the textile industries in Saxony has led to the formation of a Saxon artificial silk stock company, which will erect a mill in Elsterberg. The founding of this mill to furnish local industries with artificial silk is in keeping with the tendency to supply Saxon manufacturers with necessary materials without depending on outside sources. The phenomenal financial success of the mill recently built in Plauen for making net for the lace industries, which was formerly bought more extensively in England, lends especial encouragement to the undertaking for producing artificial silk.

NYE & TREDICK'S AUTOMATIC RIBBED HOSIERY MACHINE.

This machine, as shown in the accompanying illustration Fig. 1, is known as style No. 12-B and is used for knitting ribbed legs for seamless hosiery, either straight or shaped for women and children, also bicycle hose, leggings, and mittens, either from silk, cotton, worsted or woolen yarns. This is a two-feed machine and is built on the Nye & Tredick principle of revolving needle cylinders, the bobbins being stationary, thus reducing the surface bearings and friction to a minimum and preventing a great deal of wear, and waste of power. The cam systems are so constructed that the connections are protected from contact with the needles. The needles are given positive motion, by having the cams actuated through direct connected levers which are operated from pattern chains. The result is that a very uniform and even fabric is produced. Guard cams are used to prevent the needles from running out of their courses, thus making it safe to run the machine at a higher rate of speed with a consequent increase in production. All of the parts are adjustable and easily set for knitting cotton, silk, lisle thread, wool, etc. The bobbin racks are not connected with the movable parts of the machine, their supports being entirely independent, the only weight on the dial shaft being the cam and needle dial, thus reducing the possibility of the needles getting out of alignment from unevenly distributed weight. The yarn bobbins being stationary, allows any number of threads to be used in one feed, which is a very important feature in plating goods or knitting fabrics from more than one kind of yarn. The entire surface of the revolving fabric continually passes the eye of the operative, thus facilitating the detection of defects caused by worn needles, etc. All parts are interchangeable.

Fig. 1. Nye & Tredick's Automatic Ribbed Hosiery Machine.

The shaping of the fabric is accomplished by alternately knitting a tuck and a plain stitch, the former widening the fabric and the latter narrowing it. These changes are effected automatically without stopping the machine, by means of pattern chains and levers actuating the needle cams to cause the needles to knit either a tuck or a plain stitch as may be desired. The tuck stitch is obtained by actuating the dial needles to cast off two loops at every other course. The cylinder needles continue to cast off at every course. Various fancy designs may be knit automatically, from yarns of one or two colors; and also checked and striped effects in tuck stitch by alternating the tucking cam.

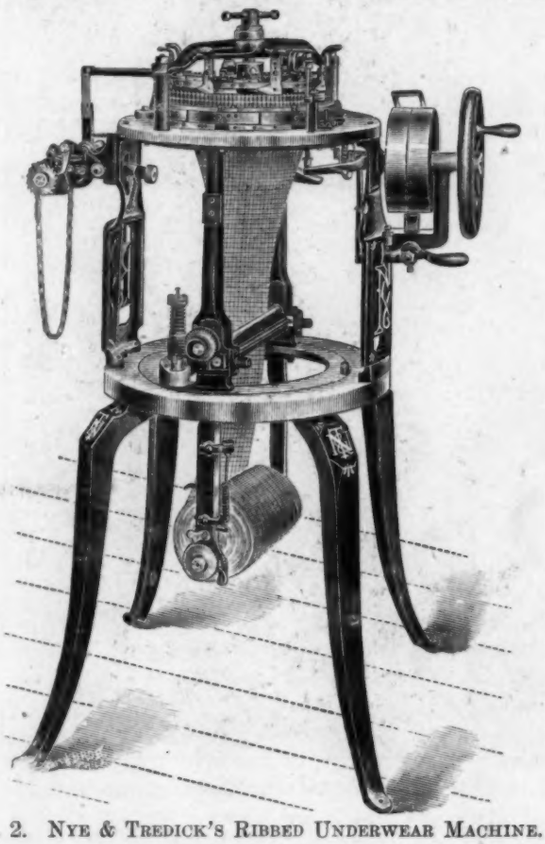


Fig. 2. Nye & Tredick's Ribbed Underwear Machine.

All changes of patterns or lengths of fabrics are easily made by simply changing the links in the pattern chains. This machine automatically finishes the top of the fabric with a welt and makes a loose course for transferring to the needles of a plain knitting machine for making the foot.

The machine has an improved take-up motion which is known as a self-adjusting weight take-up, without ratchets, levers, or springs, and is adapted for knitting the most tender yarns and at the same time enabling the machine to be run at the highest speed. The pattern arrangement has a special device for using short pattern chains, the length of a fabric being regulated by a single idler chain. The weight of a fabric may be varied on any particular gauge of machine by simply changing the yarns, as each gauge will knit several numbers of yarn by adjust-

ing the machine accordingly. The gauge on the machine may be changed by putting in a different gauge cylinder and dial, without the necessity of making any other changes. This machine is built in different diameters, from 3¼ to 6 inches, each size varying by one-quarter of an inch. Bobbin stands are provided for four bobbins so that two threads of yarn may be run to each fed. In making hosiery, one machine is generally used for each size and half size.

There are different modifications of this style automatic rib knitting machine as follows:

Style No. 12-D has an attachment for knitting a full cardigan stitch which is accomplished by tucking on both the cylinder and dial needles, which makes the fabric thicker being especially suitable for leggings.

Style No. 20 is the same as the No. 12-B except that it does not finish the top of the fabric with a welt; it is built for a less expensive machine. It is used extensively for hosiery and for knitting the plain tops of sewed welts.

Style No. 2 is used for straight fabrics only, that is, it does not contain a shaping mechanism, and does not have the attachments for tucking, welting or making a loose course. It is used principally for hosiery with cut feet, the tops of which are finished with a sewed welt.

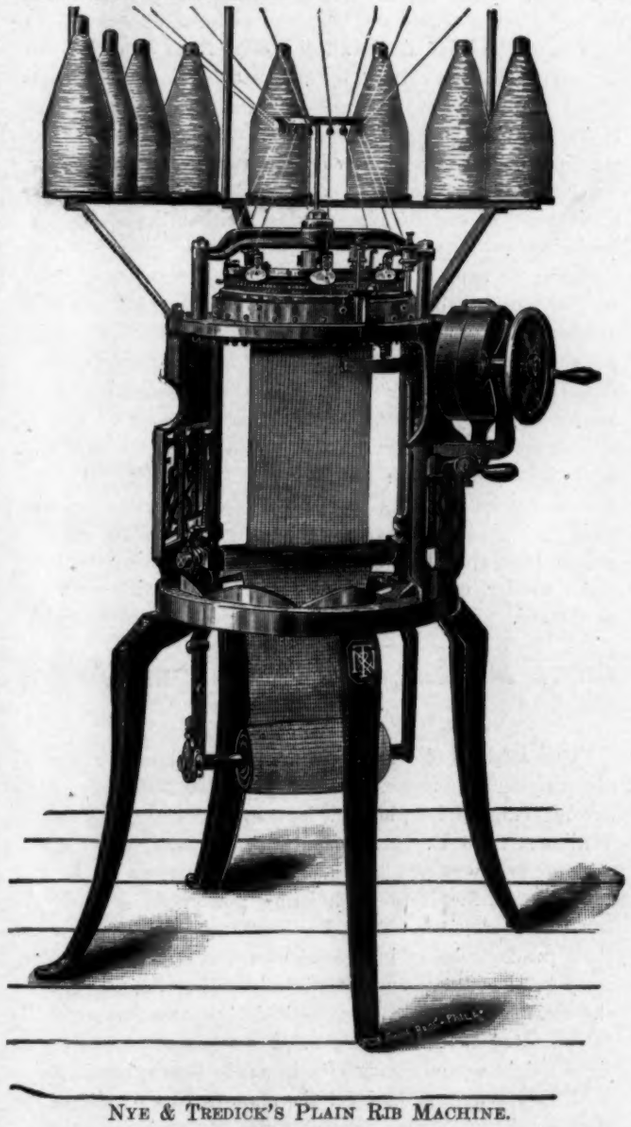
Style No. 8 is used for making ribbed tops for half hose and is very similar to No. 12-B except that it is not provided with the improved attachment for short pattern chains which are not needed for short fabrics, and it does not knit fancy designs nor shaped fabrics. It will, however, automatically finish the top of the fabric with a welt, and will make a loose course for transferring the work to a plain hosiery machine. It is designed especially for making ribbed top for half hose, and can be used for plain ribbed hosiery of any kind. It is made with either one or two-yarn feeds, as may be desired, and two threads of yarns may be used for each feed. Two-feed machines are preferable, except where a small production is desired or weak yarns are being used. The production varies with the grade of goods being made, the average for the one-feed machine being 20 to 35 dozen pairs of tops per day, and with the two-feed machine, 40 to 60 dozens pairs per day.

NYE & TREDICK'S RIBBED UNDERWEAR MACHINE.

This machine embodies the revolving needle cylinder principle, and is known as style No. 115.

It is used for knitting all kinds of straight or shaped fabrics of silk, worsted, lisle-thread or cotton, such as women's shaped shirts, skirts, men's shirts with a tucked body and a plain bottom, and cut garments such as combinations, tights, corsage covers, bicycle suits, etc. But it is especially adapted for such articles as require shaping during the process of knitting. The shaping is accomplished by knitting a tucked or a plain stitch according to the effect desired. The former stitch widens and the latter narrows the fabric. The change is effected automatically, without stopping the machine, by means of a single pattern-chain and a lever actuating the needle cams to cause the needles to knit either a plain or a tucked stitch as may be required. All the various fancy tucked stitches can be made by simply changing the screws that connect the cams which may be very quickly done, without taking the machine apart or disturbing its adjustment.

The machine is built in all diameters from 7 to 24 inches inclusive, the sizes varying by one inch. This machine is made with 4, 6 or 8 feeds, according to the size of the machine. It has all the latest improvements used in this class of machinery, including a new improved screw take-up as shown in the illustration.



Nye & Tredick's Plain Rib Machine.

The needle-cylinders and dials are cut for any gauge or number of needles. The weight of fabric may be varied on any particular gauge by changing the yarn, as each guage will knit several numbers of yarn by adjusting the machine. The gauge of a machine may be altered by putting in a different gauge cylinder and dial, with no other changes.

An automatic winder may be used as shown in the illustration, or a cam may be substituted.

NYE & TREDICK'S PLAIN RIB KNITTING MACHINE.

This machine known as style No. 118 and shown in the accompanying illustration, knits the plain and tucked stitches, and is used for making straight fabrics of silk, worsted, lisle-thread or cotton, such as men's shirts and drawers, Swiss or 2-and-2 ribbed shirts, plain underwear

for women and children, cloth for making cut garments, such as combinations, tights, corsage covers, etc., or any article not requiring a change of stitch during the process of knitting. It will make all the stitches made on the automatic machine, but will not change from one stitch to another during the process of knitting. The cams when set for a given stitch will continue to knit the same.

The machine is built in all diameters from 7 to 24 inches inclusive, the sizes varying by one inch. It is made in 4, 6, 8 and 12 feeds, according to the diameter of the machine. It has all the latest improvements used on this class of machinery, and is complete in every respect.

Cans for receiving the work may be used or the automatic winder; and bobbin stands of either the straight or semi-circular pattern, or with two bobbin-pins for each feed may be had.

The needle cylinders and dials are cut for any gauge or number of needles. The weight of fabric may be varied on any particular gauge by changing the yarn, as each guage will knit several numbers of yarn by adjusting the machine to the yarn used. The gauge of a machine may be altered by putting in a different gauge cylinder and dial. No other changes are necessary. This machine is made with a ratchet take-up as shown in illustration, or with their "new improved screw take-up" which is an absolute weight take-up. The machine is also fitted with the automatic winder, or work roll shown in cut, or with work can as desired.

SCOTT & WILLIAMS' RIBBED UNDERWEAR MACHINE.

This latch needle underwear machine, shown in the accompanying illustration, is designed on the stationary cylinder and dial principle, and is manufactured by Scott & Williams, 2079 E. Cumberland St., Philadelphia, Pa.

This firm was established in 1865, and is one of the best known manufacturers of knitting machines. During the last two years their output has increased over 50 per cent., their products being in use all over the world. This company has been very energetic in advocating the adoption of the most approved modern methods by manufacturers. It is estimated that there are 2,865 machines manufacturing light weight summer garments, in use in Pennsylvania alone.

This machine is used for the manufacture of ribbed underwear, in which two general styles are made—one known as shaped goods, the other as straight goods. The machine is built in sizes varying by single inches, from 7 inches diameter to 20 inches diameter. The number of feeds is dependent on the size of the machine; eight feeds are employed in all sizes down to 10 inches diameter; below 10 inches, six feeds are used. Goods of this character may again be divided into three classes—men's, women's and children's. Sizes up to 10 inches are for children's goods; 11, 12 and 13 inches are usually used for making ladies' shaped goods, and 13, 14 and 15 inches for making straight goods. Shaped goods are usually made in what is known as the 1 and 1 stitch using all the needles in both cylinder and dial. Straight goods are usually made in the 2 and 2 stitch, with every third needle out of both cylinder and dial. This stitch is also called the Richelieu, and produces an exact duplication of the well known Swiss double ribbed stitch. Other combinations of stitches are possible, but the sizes required are materially affected.

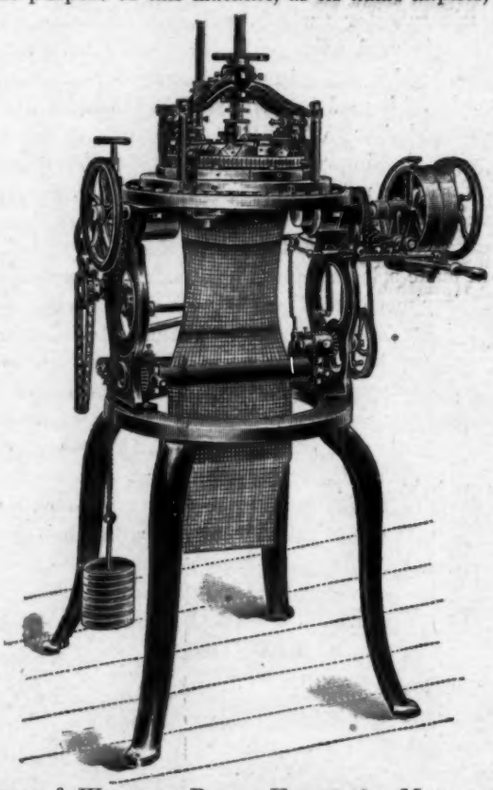
The automatic change from plain rib to tucked rib is effected on this machine, and either kind of rib can be run for any length. This machine is fitted with a measuring device for measuring the fabric by inches instead of courses, thus insuring uniform length at all times. Steel cylinders and dials are used and can be cut up to 14 needles to the inch in each. It is customary to use 8 needles to 1 inch for shaped goods, and 11 needles or 12 needles to 1 inch for straight goods.

The speed of the machine varies according to size. A 13-inch machine will run safely at 55 revolutions per minute, according to the grade of yarn used—other sizes in proportion.

The production of shaped goods on a 13-inch machine will be about 15 dozen per day of 10 hours, weighing 7½ lbs. per dozen; and about 22 dozen of straight goods. It must be borne in mind that the proportion of any knitting machine varies with and is dependent upon the texture of the fabric.

SCOTT & WILLIAMS' SLEEVE MACHINE.

The purpose of this machine, as its name implies, is the



Scott & Williams Ribbed Underwear Machine.

making of shaped ribbed sleeves, with a welt for use in connection with shaped ribbed shirts. It is usually built in three sizes for this purpose: 4¾ inches, 4½ inches, and 4¼ inches diameter. To follow a fabric made on 8 to 1 inch body machines the 4¾ inch is usually made with 104 needles in cylinder and 104 in the dial; 4½ inches, 36 needles, and 4¼ inches 88 needles. It is frequently built in special gauges. The machine is built with two feeds and by means of the pattern arrangement any length of sleeve or rib leg may be made, with welt and slack courses made at the desired places.

DIRECTIONS FOR ADJUSTING SCOTT & WILLIAMS' RIB KNITTING MACHINES.

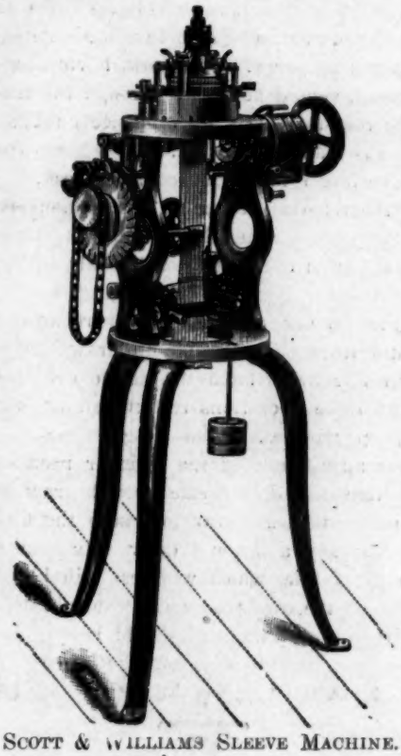
In order to slacken the fabric, two movements may be

made, either by depressing the draw-down cam in the rings, so that the needles will draw more loop, or by elevating the dial. This last operation is performed by loosening the retaining screw in the cross-bar, and turning the thread nut in the direction calculated to raise the spindle, and the cap and dial which are carried thereby. As a general rule, the dial should not be worked higher than is sufficient to give ample space for the passage of the thickest portion of the work; and further slackening of the fabric should be attained by recourse to the draw-down cam, as explained. On single-feed machines no difficulty of unevenness of fabrics will arise, but upon multiple feed machines it is of first importance that each and every feed should draw exactly the same length of stitch; otherwise unevenness of fabric and unsightly effects are sure to be produced. With a multiple feed machine, where uneven adjustment is apparent in the fabric, it is difficult to locate the particular feed which is too stiff or too slack. The simple method of marking the yarn of each feed is recommended. Twist each yarn in the fingers which are more or less soiled by oil, so that each marking comes at precisely the same distance from the hole in the yarn guides, and then turn the machine slowly by hand and observe closely whether or not all these marks reach the holes in the guides at the same time. Those that reach this destination first are being knit in the machine more rapidly than the others, which means that the feeds so affected are drawing more yarn; and adjustment should be made accordingly. This should be repeated until all the marks reach the holes in the guides at the same instant. This is an indication that the machine is doing even work.

The next important point to observe is the adjustment of the cap which operated the dial needles. This, in a well adjusted machine, should bear a certain relation to the cam-ring which actuates the cylinder needles. Care should be taken to see that the cylinder needle draws down at the right time, so that it lays its threads upon the latch just to the rear of the rivet of the dial needle. This relation is governed by the circumferential adjustment of the cap on the center spindle. Then see to the adjustment of the yarn guide. Assuming that the needle possesses a mechanism for making a slack course, the guides should be so set that the latch of the cylinder needle, when closing will just clear the rear end of the guide when the slack course is being made. Care should also be taken that the latches of both sets of needles are not permitted by the guide to close down upon the hooks of the needles. The forward end of the guide is supposed to intercept any latch that may be inclined to flirt shut. It is also important to see that the guide occupies such a vertical position that there is sufficient room for the hooks of the dial needles to pass under the lower edge of the guide.

PRESS-OFFS.

In the event of the work being run off the needles from any cause whatever, the first thing to do is to introduce a needle, held in the fingers, down through the space between the cylinder and the dial, and with the hook of this needle catch a narrow yet firm hold of the edge of the fabric which is to be introduced to the needles. Pull this fabric up until it can be grasped by the fingers of the right hand. Introduce the left hand underneath, and through the hole in the needle cylinder, grasp the fabric therewith and by a sawing motion force the work between one of the sets of dogs which prevents the dials from turning. The machine should have been turned at this point, so that one of the resting points for the cylinder needles comes where the work is inserted between the cylinder and dial. At such points the cylinder needles are partially elevated, so that it is a comparatively easy matter to jab the edge of the work on to said needles. Care should be taken, however,



Scott & Williams Sleeve Machine.

not to get it on with too much margin—an eighth of an inch, or even less is ample. After once having secured a start with the fabric, it must be jabbed on the needles a little at a time, and the machine slowly turned until the first yarn guide (or set of cams) comes to the point where the work was started on the needles. It is then time to thread up the guide so that the needles will begin to knit, proceeding thus until the other set of dogs is reached. It is again necessary to get the work between the dogs by a sawing motion, after which continue jabbing on the work all the way around to the starting point, care being taken of course, upon a multiple feed machine, to see that each guide contains the thread or is properly threaded, when it arrives at the starting point. The work should now be inserted between the take-up rolls, and too much tension should not be applied until the rough edge of the run-on portion of the fabric is off the needles. The machine should be turned very slowly with all latches opened and drop stitches picked up. The machine is then ready to operate. Care should be taken that the take-up rolls are not pressed together with an undue tension and are even and in a parallel line—that is, that they do not pull more on one side than on the other. A special screw adjustment is present to correct these matters. In the event of a broken needle or a broken cam, the first thing to do is to remove the tension from the work by slackening it up in the take-up rolls. Now, to remove the section of the cam ring and take out entirely the retaining screw which goes through the solid outer ring; then raise the section until it is above the upper level of the outer ring, when it may

be withdrawn. The lower and inner section is now to be drawn away from the needle cylinder until it can be freely removed, which discloses the needle cylinder, so that difficulty may be located. The trouble having been corrected and the broken needles or cams removed to restore the sections to their proper places, raise all the needles to a point above the cams of the lower section. Force this section up to the cylinder, drop the middle section in and secure with the retaining screw. The work, having been loosened in the take-up, should be drawn through the take-up rolls, so that the take-up exerts its influence on the work, and the machine is ready to proceed.

With the larger multiple-feed machines for underwear purposes, the removal of one of the sections is somewhat different, and should be handled as follows: The work should be first eased from the control of the take-up, so that it is free from strain. Remove the retaining screw, as in the case of the smaller machines; then remove the central section, and it is now possible to draw the cam section in a direct line away from the needle cylinder. The reverse of all these operations restores all the various parts to their proper places.

For the adjustment of the cylinder needle cams, it is necessary that the dial needle should draw back within the dial only sufficiently far to insure the knocking over of its stitch; any additional draw only means an undue strain on the fabric, which will result in bad work. The adjustment of the disc rod, which controls the levers connected with the cams in cap, should receive careful attention. See that it does not strike both levers at the same time. Its proper vertical position will be apparent after a close examination of the elevating lugs or links on the drums, and the function of the two change levers has been correctly understood.

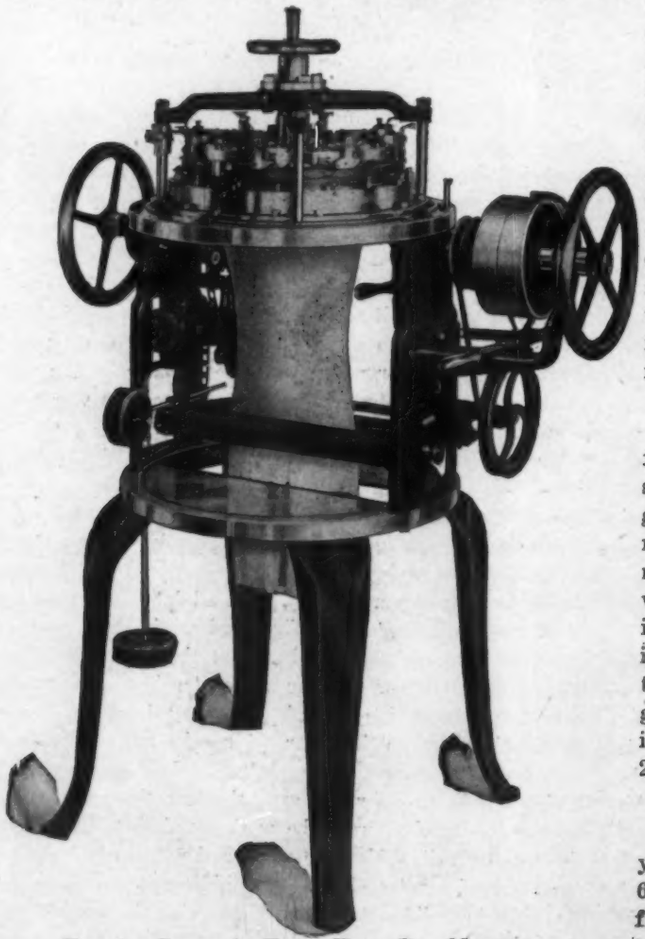


Fig. 1. Snyder's Eight-Feed B Machine.

SNYDER'S AUTOMATIC CIRCULAR RIB KNITTING MACHINE.

This style of machine, shown in the illustration, Fig. 1 contains eight feeds, and is used for making practically everything known to the trade in underwear, including light and heavy weights for men, women, or children, and in practically all gauges. The machine is manufactured by the H. P. Snyder Mfg. Co., Little Falls, N. Y. The Snyder rib knitting machines are of the revolving top type, that is, the needle cylinder and dial cap remain stationary, while the cam cylinder and dial cap revolve. An important point in this connection, is the fact that the cap and cam rings are made in sections, which allows of ready access in case of accident. This machine is also adapted for making sweater fabrics in fancy stitches. It embodies all of the improvements brought out by the company. By referring to the illustration, it will be seen that a new device is used for taking down the cloth, which does away with all cams, levers, ratchets, dogs, and pawls. This machine is adapted for running at the highest rate of speed possible for this type and as high as seventy turns per minute may be reached, resulting in a large production in connection with the eight feeds.

The cylinder and dial are made from special quality forged steel, thoroughly hardened and the plates and cams are forged from the best quality of Jessop steel properly hardened. The thread guides are made from special cold rolled steel and hardened. All of the bearings are ground and properly fitted. A graduated wheel is located on the top of the cross arm, for measuring the stitch. The cross arm is composed of four arms which makes the cap of the machine perfectly rigid, at the same time leaving plenty of room to work around the machine, in case of accident or when putting on the cloth after a run off. The yoke is fitted with an adjustable center for truing and centering the dial. This type of machine is made in different sizes from 7½ inches to 26 inches, and in all gauges from 3 needles per inch to 12 needles per inch.

SNYDER'S AUTOMATIC RIB SLEEVER.

This machine as shown in the illustration Fig. 2 is used for making sleeves for ladies' ribbed underwear, leggings, stocking tops, cuffs for fleeced lined underwear, tubing, glove linings, sweater trimmings, tufting, etc. It is of the revolving top type, which is characteristic of the Snyder machines. A pattern wheel and pattern chain are provided for making welts and slack courses at the proper intervals while knitting the ribbed sleeves. The machine is provided with two feeds and is adapted for making the tuck stitch when required. The machine is made in all gauges, and in different sizes varying from 1 inch to 5 inches. This machine can be successfully operated at from 200 to 400 turns per minute.

From the total imports of the United States for the year ending December 31, 1909, amounting to $1,320,609,250, over $700,000,000 were from Europe, $148,000,000 from South America, $200,000,000 from Asia and Oceanic and $12,000,000 from Africa.

STAFFORD & HOLT'S AUTOMATIC RIB SHIRT AND DRAWER MACHINE.

This machine as shown in Fig. 1 is manufactured by Stafford & Holt, Little Falls, N. Y. The machine is built on the revolving needle cylinder principle, and is used for making ribbed shirts and drawers. The machine is made in different sizes ranging from 3 to 24 inches. The number of feeds varies from 1 to 20 according to the size of the machine.

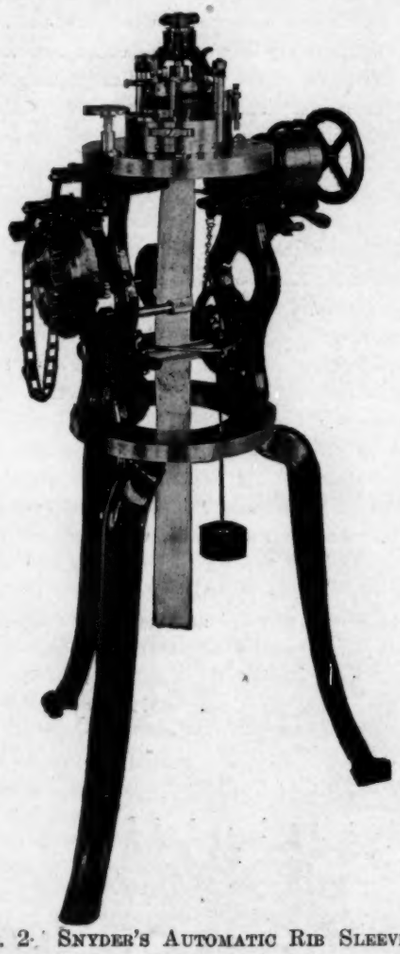


Fig. 2. Snyder's Automatic Rib Sleever.

The cylinder needles are reciprocated vertically in slots in the needle cylinder. The cylinder is constructed from steel forgings of superior quality, as the requirements are very severe; the needle walls are hard enough not to jab too easily and not hard enough to break. The cut across the face of the cylinder for the needle is called the needle slot; the part between the slots is called the land or sometimes needle wall. The slot is widened at the top so as to clear the yarn when drawn into the slot by the needle. This widened part is often called the sinker cut. The narrow radial face is called the top and the adjacent face the bevel of the cylinder. The cams are known respectively as the rise cam, the stitch cam, the fill-in cam and the guard cam. These are all stationary except the stitch cam, which can be adjusted for slackening or tightening the stitch. The stitch cam extends up into the gib, which is slotted to receive it, so that when it is pushed up or down the extreme point is covered by the gib, and a needle that should be drawn beyond its normal limit will be forced into its proper position on striking this cam. The first rise on the rise cams opens the latch needle, and should be long enough to get all latches open before reaching the yarn guide, but comparatively shorter than the rise cam on the dial. The stitch cam should be as steep as practical, especially that part of it which actuates the needles from the time the yarn draws through the dial needles. One end of the fill-in or connecting cam is made low enough for the needle to pass around the stitch cam and the other end high enough to return the hook of the needle about ⅛ inch above the cylinder top, for convenience in starting the machine; also to assist holding the work in position on the dial needle when it starts to advance.

In the automatic machines the tuck stitch which widens the fabric is made by the dial needles by shoving the outer point of the rise cam in the dial cap back so as not to allow the loop in the dial needle hook to pass off the latch. The needle retains this loop in the hook and at the next feed takes another loop. It usually passes both loops over the latch together, thus combining two cylinder stitches with one dial stitch. The dial rise cam should start to project the needle slightly in advance of the cylinder rise cam as the cylinder needles are in a better position to assist in holding the stitch in position. The dial stitch cam is made adjustable to tighten or loosen the stitch and is of such shape as not to close the latches too quickly on the yarn that the cylinder needles are taking; and then complete stitch just as quickly as possible. The guard cams on both cylinder and dial are used solely to prevent needles getting misplaced. The yarn is fed into the cylinder needles, which draw it down into the hooks of the dial needles. The position of the two sets of needles in respect to each other is very important, as the results can be varied widely by changing this, and the remarks above in regard to cams have reference to underwear as generally made.

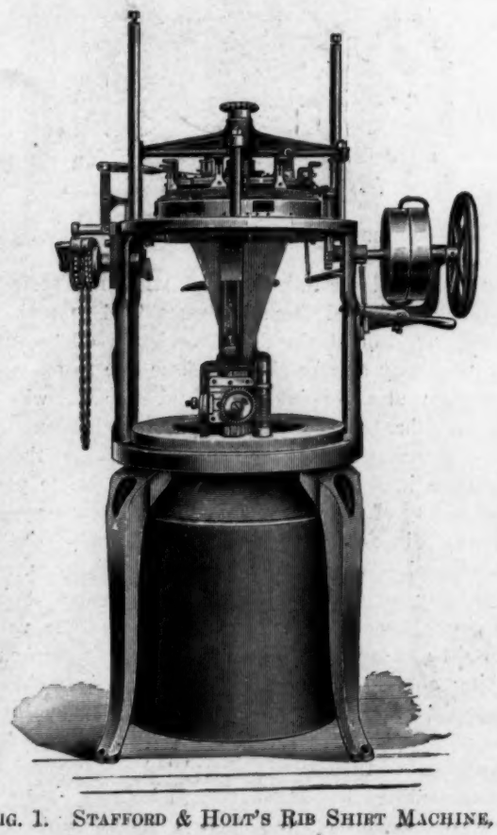


Fig. 1. Stafford & Holt's Rib Shirt Machine.

STAFFORD & HOLT'S PINEAPPLE STITCH MACHINE.

This machine is shown in the illustration, Fig. 1. It embodies the revolving needle cylinder principle, and makes the same class of fabric as the three and four lock system of parallel bed machines, but with the addition of a number of feeds which multiply the production of the straight machine ten fold and more, and in addition readily makes many combinations of colors and stitches. A diagram of the pineapple stitch made by this machine is shown in Fig. 2.

The production of the pineapple stitch is made by the dial needles principally, which are made for some of them

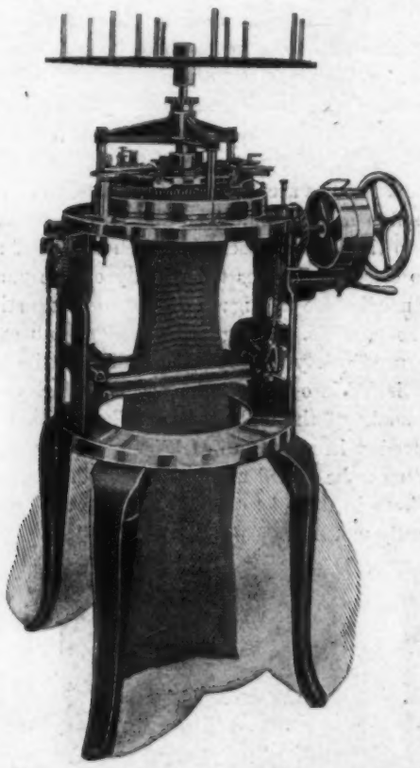


Fig. 1. Stafford & Holt's Pineapple Stitch Machine.

to knit plain, others to knit a tuck stitch and some to skip the thread delivered from the same feed to such needles successively, and at the same revolution of the machine. The stitch may also be changed from one to another form of cardigan at any point of the operation. It will thus be seen that the fabric produced is a combination of plain, welt, and tuck stitches. By the combination of these forms of stitches in any way desired, it is possible to produce a great variety of fabrics, by the different arrangement of the stitches. Six feeds are used in the machine shown. As different colored yarns may be used on the feeds, and each needle may be operated to produce any stitch at any feed the colors can be given prominence, and the variety of effects be enlarged. When the needle is spoken of as making a tuck stitch or welt stitch, it is understood to mean that the needle is operated at that point in the operation to tuck the thread or to skip the thread, though properly the stitch is not completed until combined with the succeeding plain stitch formed by that needle, that is, the needle is operated to take a thread without casting its old loop, or to miss the thread without casting its loop, instead of casting an old loop over a new one to form a plain stitch.

The method of producing the different styles of stitches on the needles is best shown by referring to Fig. 3, which is a diagram of the dial cap, showing the locations of the cams, and their needles. As shown, there are two sets of needles that alternate with each other in the dial, one set being long needles and the other short needles, the difference being in the length of the shank between the hook and the butt. There are two cam grooves, the butts of the short needles passing between the outer two angular cam sets, and the butts of the long needles passing between the inner two cam sets. The cam plates being stationary, and the dial revolving, the needles in the grooves of the dial play in and out to form the proper stitches. On this machine there are six feeds indicated at 13, 14, 15, 16, 17 and 18. There are provided movable throat cams, 1, 3, 5, 7, 9 and 11 for the outer angular cam groove and the throat cams 2, 4, 6, 8, 10 and 12 for the inner cam groove. These throat cams are made movable to produce plain, tuck, or welt stitches as required and are operated by the proper mechanism to produce the desired result. The operation of the machine in the production of the "pineapple" pattern, is as follows: The throat cams 1, 2, 3 and 4 are so placed that both the long and short abutting needles will cast off old loops and knit plain. The cams 5, 7, 9 and 11 will cause the short needles passing therethrough to make the tuck stitch, while cams 6, 8, 10 and 12 will cause the long needles to be withdrawn, so as not to take any yarn. The threads retain such positions during one revolution of the dial and needle cylinder. The effect is that the short needle A3, at cam 1 has just taken the thread and been projected, so far that the threads heretofore on the needle have been slid back of the needle latch. The needle being withdrawn, as illustrated at A1, has cast off the stitches that were behind the latch, but has retained the stitch which it took at feed 13. When the needle

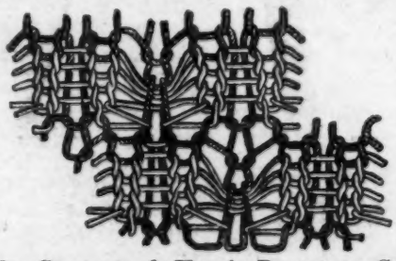


Fig. 2. Stafford & Holt's Pineapple Stitch.

comes to cam 3, it casts off a stitch and takes another yarn, which it holds. The same work is done by all the succeeding needles as they pass through cams 1, 2, 3 and 4. At each such point in the fabric, therefore, the work done by the needle which formed the fabric, at that point has been plain stitching or casting off, and we have in one revolution a row of such work made up of a number of stitches limited by the cams doing plain work.

The long needles B1—B13, then come to the cam 6, where they are fully drawn inwardly and the yarn that was taken at cam 4, is withdrawn by the needle, and the knitting is done by the cylinder needles, which results in forming a welt stitch. The thread taken by the needle B1 at the point 4 is held in the inner surface of the fabric, and prominence is given to the stitches formed by the

other needles. This operation is repeated, or rather the condition is maintained, while these long needles pass through cams 8, 10 and 12. While this is going on, short needles A1—A13 are passing through cams 5, 7, 9 and 11, which are in position for making the tuck stitch. While

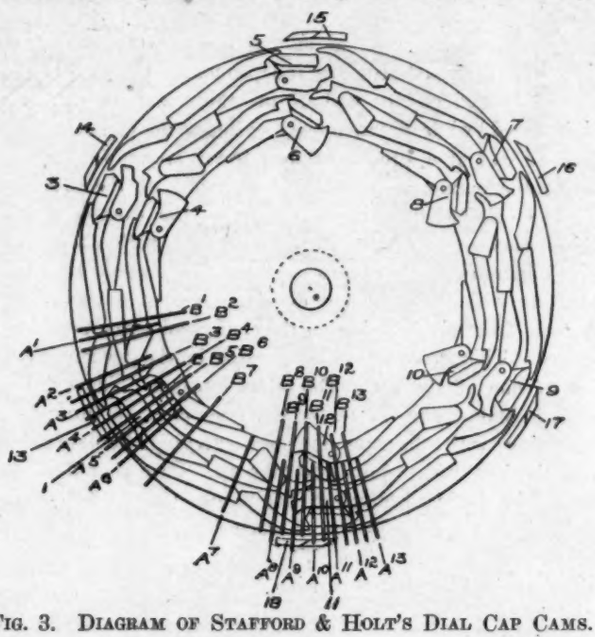


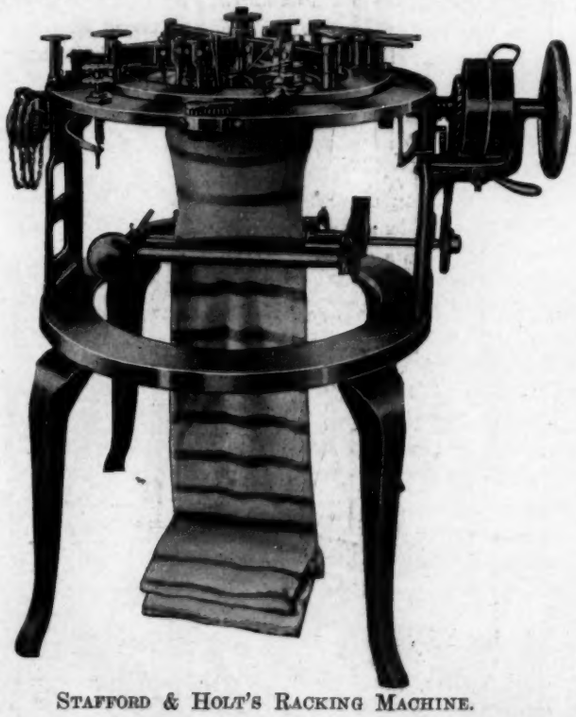
Fig. 3. Diagram of Stafford & Holt's Dial Cap Cams.

passing through these cams each of these short needles is partly projected, so that it takes the additional yarns fed at each of these points, by the feeds 16, 17 and 18 and holds them in the eye of the short needle until it comes again to cam 1. By this time it has taken four such additional threads and is projected, so as to cast off the accumulated yarns and make a new loop of the thread taken at cam 1. This operation is called "tuck-stitching," and it has brought toward one surface of the fabric the threads taken at the cams 5, 7, 9 and 11, throwing into prominence on the other face of the fabric the threads taken at 1 and 3. The effect is that there has been produced in one operation of the machine a layer or row of plain stitches, above which are four welt-stitches together, and next laterally are four tuck stitches. After one revolution of the dial and needle cylinders the throat cams 5, 7, 9 and 11 are shifted inwardly to the welting position, and the throat cams 6, 8, 10 and 12 are shifted outwardly to tucking positions, cams 1, 2, 3 and 4 remaining fixed for making the plain stitch. This new arrangement of the cams produces a row of plain stitches next to the row of alternative tuck and welt, after which is knitted a row of alternate welt and tuck stitches, the welt stitch being grouped in diagonal rows in reference to each other, the tuck stitches representing diagonally-arranged interstices or depressions. At the third revolution of the dial and needle cylinder the cams are shifted to the first position, explained and shown in diagram Fig. 3. The work goes on in that way as long as may be desired. Different colored threads may be fed at different points, and by the arrangement of the throat cams and the disposition of the needles in the dial a vast number of patterns may be produced.

The value of exports of raw cotton from the United States in January, 1910, was $37,750,000, compared with $52,500,000 for January, 1909.

STAFFORD & HOLT'S AUTOMATIC RACKING MACHINE.

This machine, as shown in the accompanying illustration, is used for knitting automatically all classes of fabrics requiring a racked or shogged stitch, such as is often used for sweaters, jackets, coats, collarettes, gloves, etc. The machine is of the revolving needle cylinder type, using two sets of needles as for ribbed work. The machine receives its name from the fact that it racks the needles, that is, it carries the inner ends of the dial needles to one side or the other of its adjacent cylinder needle, thus forming a racked stitch. One characteristic of this machine is that the hooks of the dial needles point inwardly instead of extending radially as in the rib machine. The racking arrangement is simple, convenient, and automatically adjusts itself, so as to change only when both sets of needles are clear of each other, thus avoiding any trouble from this source. The machine is constructed to make automatically the one and one rib, the royal rib, or sweater stitch, and the racked stitch in any desired combination. The ma-



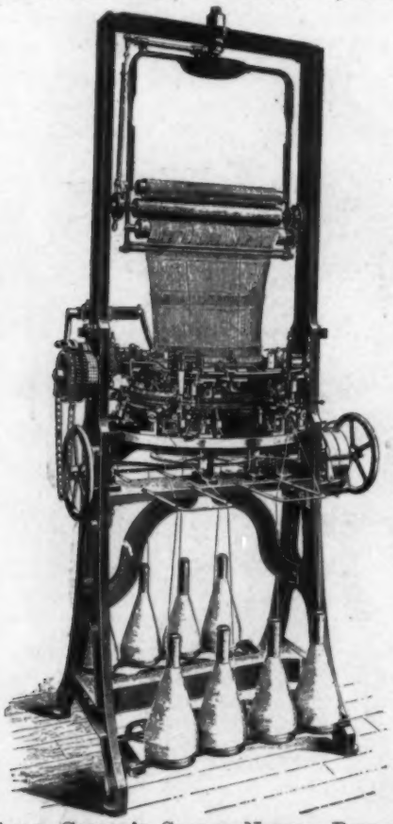
Stafford & Holt's Racking Machine.

chine is also made to produce the honey comb and pine-apple stitches in combination with the above mentioned stitches. A striping arrangement may also be had on this machine. The machine is constructed so that each or any of the needles racking sections may be moved as the feeds give the yarns to the needles to be racked. Each section of the dial needles may be racked when no work is done by those needles (the yarn feeds and the operating cams, which are adjacent thereto, being over a different section) in readiness for the coming of the feeds and the cams in the revolution of the cam plate and its component parts.

With this construction a garment may have the racked stitch throughout, or only in certain parts as required. The Crawford stop motion can be applied to these machines. The cylinder and plates are cut from steel forgings and when completed are hardened. The take-up is of the swinging weight, band driven type, which is reliable, easily adjusted, and requires little attention.

CHARLES COOPER'S CIRCULAR RIBBED TOP SPRING NEEDLE KNITTING MACHINE.

This machine, as shown in the accompanying illustration, is manufactured by Chas. Cooper, Bennington, Vt., and is used for producing shirt cuffs, drawer bottoms, shirt borders, and stocking tops. Two sets of needles are required in the machine for the production of the ribbed fabric. A pattern wheel and chain are used in order to operate the mechanism for producing welts, slack courses, and tuck stitch. The length of the fabric under operation is regulated by the pattern chain, and any desired length may be obtained by the proper arrangement of the lugs on the chain. This machine is made in regular sizes of 21-inch cylinders with four feeds, and 23-inch cylinders with six



Chas. Cooper's Spring Needle Ribber.

feeds. Any number of needles per inch may be had as required. The production of a machine cut twenty-eight needles to the inch, of 23-inch size, with six feeds, will be about eighty dozen pairs of cuffs, or sixty-five dozen pairs of drawer bottoms per day, if made the usual length; and on a 21-inch machine the production would be in proportion. The speed of the machine varies according to the size and gauge. The machine is fully protected by patents in the United States, Great Britain, Canada, and the principal countries of Europe.

To produce uniform sizing it is absolutely necessary that the same quantity of starch and other ingredients by weight to be used for each mixing, and that the specific gravity, temperature and method of preparation be exactly the same. Take the temperature of the water before turning on steam, and when the size is cooked. This size should be of a complete velvety density in each tank when cooked.

TOMPKINS SPRING BEARD NEEDLE KNITTING MACHINE.

The Tompkins knitting machine is really two machines on an iron table. Each of the two heads, as they are called, is entirely independent of the other, not only as regards stopping and starting but as regards the relative speed, since the countershafts are independent. Consequently a sleever located on one end of the table may be run at a high speed, while a large body cylinder on the other end may be run at a proportionately lower speed, thus facilitating the maximum productive efficiency of the machine.

The original distinctive feature of the Tompkins machine was that of driving the take-up from within the cloth, thus eliminating superfluous overhead gearing and long side shafting with the attendant disadvantages of extra weight, damage from oil dripping on the cloth, and extra power required. This drive is well illustrated in the accompanying cut of one of the early Tompkins knitters. The cylinder stem is hollow and the center shaft projects up through it, revolving with the cylinder and carrying the spreaders and the bow which move the take-up. Care should be observed in distinguishing the Tompkins "type" of machine, of which this drive is the characteristic, from the Tompkins "make" of machine. The original patents have long since expired so that this drive is free for any one to use and is used not only in direct imitation but in machines generically different.

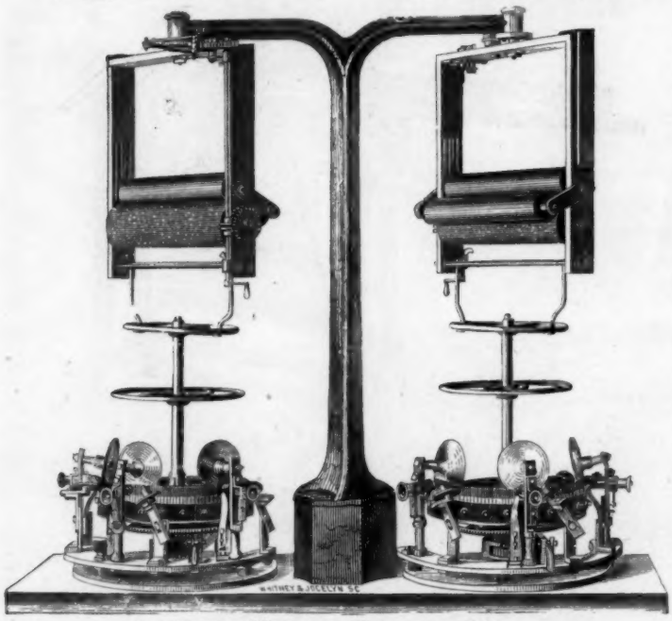
The Tompkins make of machine, although of this no longer exclusive type, is exclusive in being the one having the longest record of continuous manufacture in the Western hemisphere, for being the most universal in regard to adjustment and one of the most advanced in mechanical construction and design. Moreover, it is guaranteed by a shop having a 64-year record for endurance and integrity.

Although the cut shows what was then considered an advanced type of machine, still it may be used as a comparison in showing only a few of the improvements which have since its time advanced the Tompkins make of machine in popular favor. Consider separately the heavy take-up, the number of feeds—three per cylinder—and the non-adjustable plate for supporting the feed stands. The old style take-ups which came from England, or were copies of the English style, had cumbersome frames and a friction drive with worm and worm wheel transmission. With these conditions high speed was not advisable, and uniform tension an impossibility. A long step in advance was made when the Tompkins brothers, Albert and Ira, invented and introduced the take-up shown in the illustration of the three modern Tompkins tables driven by an Allis-Chalmers type K motor. This take-up has a malleable iron frame, sufficiently light and strong to allow of any possible needle speed; it has a spring drive with a ratchet and ratchet gear transmissions. After the expiration of the patent, this style of take-up was adopted by many other machine manufacturers not only in this country but in Europe as well.

The number of feeds on the earliest machines was one per cylinder in deference to the knitters of those times who believed that good work was impossible with more feeds, because in their opinion the stitch at the different feeds could not be made near enough alike. At the time of the old machine illustrated this prejudice had been overcome to the extent of two additional feeds, whereas present practice for plain work is not less than four, generally six,

and as high as ten. This increase of feeds was largely a result of the adjustable rings, the third point to which attention is directed.

The old stand plate was only a partial ring containing holes in which the stands were inflexibly fastened, since early practice derided the practicability of making inter-



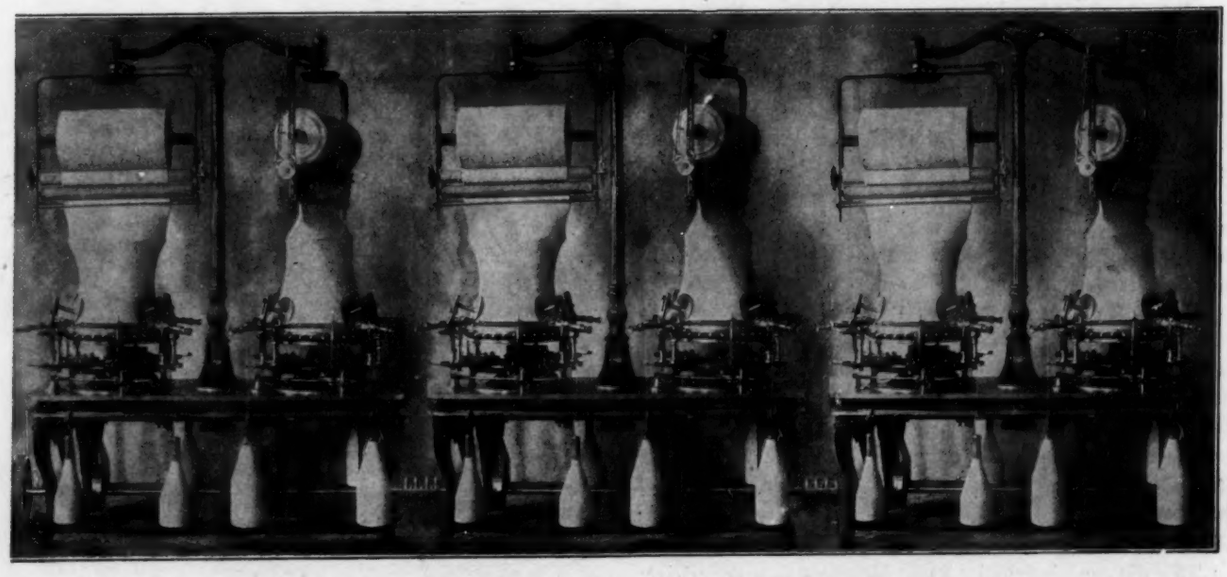
An Early Make of Tompkins Knitter.

changeable cylinders. Tompkins Bros. were the first to combat this notion by undertaking to make interchangeable cylinders, and although they met difficulties, owing to the imperfections of the machine tools of their time, still they succeeded so well that their competitors were forced to follow. It is claimed that the new removable ground cylinder stem used in the latest Tompkins machines is far ahead of anything else yet attempted in this line. The introduction of the interchangeable cylinder made necessary the radially adjustable stand support, which was the second Tompkins' innovation in the long series of convenient adjustments which has made the machine the most universal in this regard. To the radial stand adjustment was added the circumferential adjustment, which, in addition to allowing the use of different sized cylinders, facilitated the use of extra feeds, and not only this but allowed the user of the machine to arrange the feed with as many burs, or as few, as he desired and in any order that was necessary. In other words every user of the machine was the possessor of facilities for experimenting in the use of more feeds and of different arrangements of the feeds, which facilities were used to good advantage in many cases with the result of immediate benefit to the user and ultimate benefit to the whole industry.

To sum up the foregoing facts, the principal Tompkins' features are the inside take-up drive, the take-up with spring controlled ratcher drive, and the universal support for the bur stand. However, there are many other features the introduction or perfection of which is due to the manufactuers of the Tompkins' machine, such as the hardened removable bur blades throughout, hardened bur bushings and studs, cut gears, ground bur shafts, bushings, cylinder stems, etc. The Tompkins shop is at the Foot of Cypress Street, Troy, N. Y. where visitors are welcome and where the machine may be seen in operation.

CLAES & FLENTJE FLAT KNITTING MACHINE.

This flat machine is operated by hand, for making full fashioned sweaters, cardigan jackets, golf blouses, general underwear, union and bathing suits, gloves, etc. Ainslie Knitting Machine Co., Brooklyn, N. Y., is the sole agent for the United States. It is also known as a drop lock machine, and is made in sizes from twelve to twenty-six inch beds, for knitting the one and one, and two and two cardigan, half cardigan, racked and fancy stitches. It is claimed that the advantage of a flat machine, compared with a circular machine, is that any width can be operated on the same machine by simply employing the number of needles required, while, of course, on the circular machine, the full width has to be made. The flat machine also has the advantage in making selvage edged goods instead of cut goods.



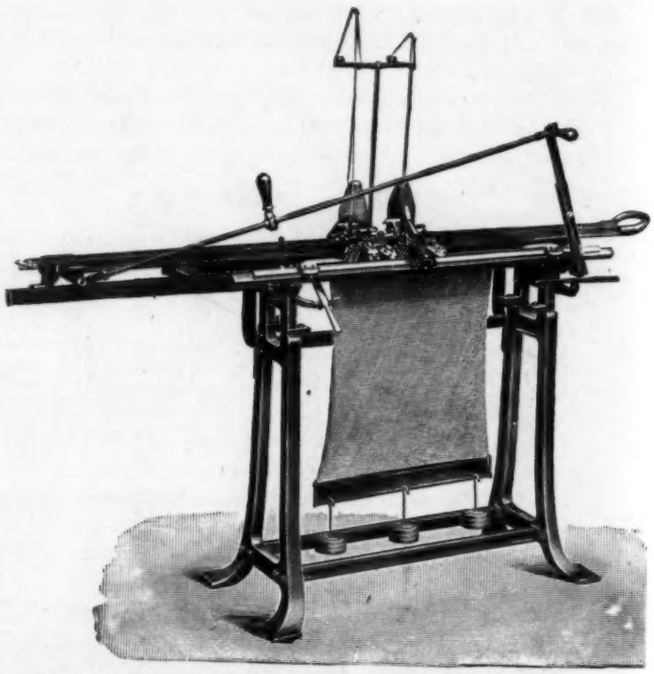
Three Modern Tompkins Knitters Driven by an Allis-Chalmers Type K Motor.

This machine has a very solid drop lock, with a one and one rib apparatus, which is easy to operate, and affords means for knitting all possible stitches. The side cams have direct tensions, sliding in slots with stopping lugs, thus permitting an easy regulation on the side of the stitch. Two or three yarn guides may be had to make striped goods, and a quick and sure change of guide is obtained by a lever, so that practically no time is lost when making striped goods.

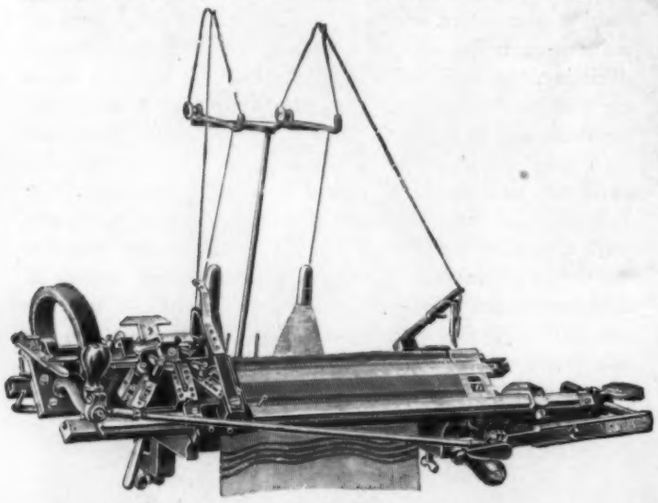
The operation of racking over one to three needles is effected by means of a racking wheel. Machines of twenty-two inch beds and larger, are generally supplied with three yarn guides, to work in three colors.

DOUBLE MECHANIC DROP LOCK MACHINE.

This is a hand machine operated by two operatives, and is made with two sets of drop locks, arranged in tandem, and working with two yarn guides to obtain a double production in the cardigan, one and one, two and two ribbed goods, or to work the transparent cardigan web, showing on the right side another color from that on the left, by using different colored yarns in the yarn guides. This is employed frequently for sweaters and other high grade goods. Plated cardigan goods may also be made on this machine, by putting cotton in one yarn guide, and wool in the other yarn guide. The left side will then show the cotton, and the right side the wool. The plain web for jerseys without a seam on the shoulders is obtained in this



Claes & Flentje's Double Mechanic Machine.



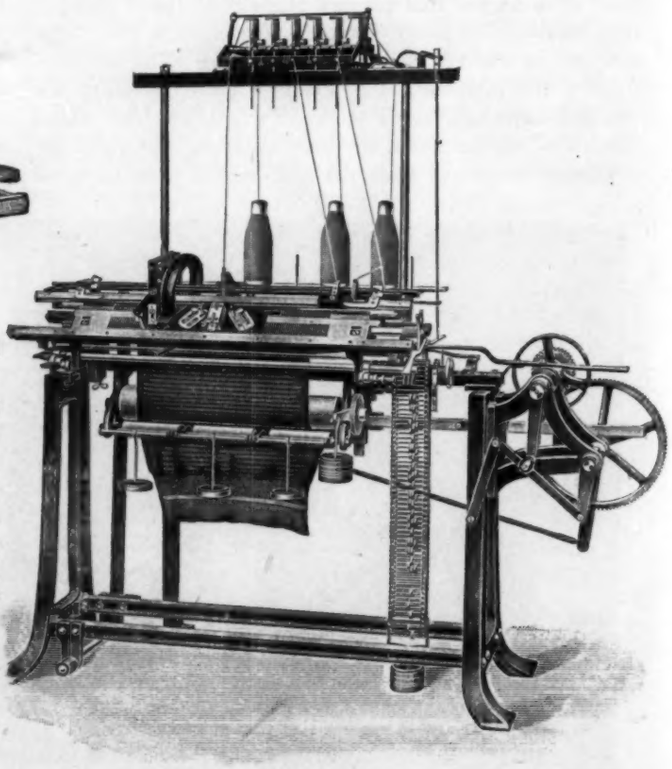
Claes & Flentje's Drop Lock Machine.

machine by working with one lock on each needle bed, and using two yarn guides at the same time.

When knitting the one and one or two and two rib with two yarn guides, each having a different color, a small striped web may be obtained, which is used for golf blouses, children's garments, etc. Two additional yarn guides may be used to obtain different stripes in plain and racked cardigans for sweaters, ladies' petticoats, etc. It is claimed that the web of the knit goods is more elastic from a flat machine than from a circular, due to the fact that the stitch is drawn on both sides of the two needle beds in the flat machine, while on the circular machine the goods are drawn around the cylinder which it is said takes some of the elasticity away from the goods.

AUTOMATIC POWER DRIVEN SWEATER MACHINE.

This flat machine, as its name indicates, is power driven and operates automatically. Fig. 3 is an illustration of this machine. It is made in different sizes from twelve to twenty-four inch beds, with automatic appliances for manufacturing full fashioned sweaters, cardigans, jerseys, blouses, general underwear, etc. It also will knit any of the ribbed and fancy stitches. The construction of the head is similar to that of the ordinary hand or drop lock machine, with long or short carriage. The illustration, Fig. 3, shows the improved cloth take-up, the automatic rack-



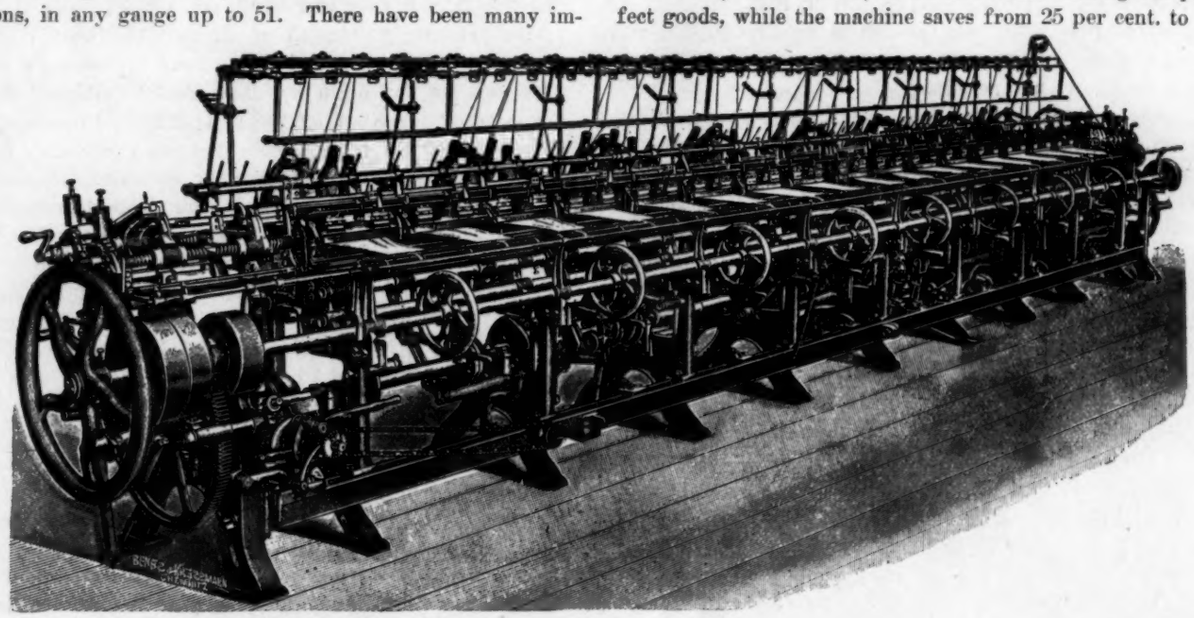
Claes & Flentje's Automatic Sweater Machine.

ing device, the changing mechanism for the yarn guide, and the electric stop motion. Besides making the above mentioned fabrics, the machine is also adapted for making all kinds of plain tubular web, rib stitches, etc.

LUDWIG'S FULL-FASHIONED HOSIERY MACHINE.

This machine, as shown in the accompanying illustration, is built on the Cotton system, and is used for making full fashioned hose and half hose. The machine is made by H. Alban Ludwig, Chemnitz, Saxony, who is represented in the United States by Louis Hirsch, 260 West Broadway, New York City. The machine is built up to 24 sections for making ladies' hose, and for men's half hose, 28 sections, in any gauge up to 51. There have been many improvements made to the machines, and especial attention is directed to the narrowing machine which has been divided in such a manner that the narrowing machine bars reach only as far as the middle of the machine and are moved by four spindles or nuts respectively. The left half of the narrowing machine is therefore moved from the left side of the machine, and the right half from the right side. In a 16-section machine the narrowing machine is equal to an 8-section machine, since only 8 sections are moved and not 16 as heretofore. The differences of contraction or expansion are minimized which occur from the change of temperature which arises on some makes in connection with the narrowing, owing to the non-fitting of the narrowing points upon the front needles. The machine is thus not affected by the temperature, and can be started without losing any time, as it is no longer necessary to wait until the temperature has become such as to be normal for the machine.

The internal cam movement is another important improvement on the Ludwig full-fashioned hosiery machine and consists of an internal cam actuating arrangement for the principal levers of the needle bars, the press and sinkers. This construction obviates the use of the large powerful springs found on most machines for drawing the levers to the eccentrics at the high point of which the springs were considerably extended. The consequence is that the strain to which the springs are exposed is rather irregular and when the lever is at the high point of the eccentric, the strain is the greatest. This irregularity has been obviated by creating for the eccentrics already existing, certain counter cams, thus providing the main lever in question with a movable arm and connecting the two lever arms by a shorter and weaker spring. In this way the spring is under a uniform and very slight strain, and only a uniform amount of power for overcoming the high point is necessary, because for each high point there is provided a correspondingly low point of the counter cam, and the two rollers at the arms of the levers do not change their respective positions. With this arrangement the number of revolutions may be increased, at the same time turning out perfect goods, while the machine saves from 25 per cent. to 30 per cent. of the power usually required to overcome the high points.



Ludwig's Full-Fashioned Hosiery Machine.

THE DAVID RICHTER FULL-FASHIONED HOSIERY MACHINE.

David Richter Inc., Chemnitz, Saxony, have recently brought out a new type of full-fashioned hosiery machine, Cotton system, called "Model 1909." The "David Richter" machine is known to American manufacturers of full fashioned hosiery since fifteen years, and is one of the most popular machines used in the United States. Manufacturers like it on account of its high production and the fine superior quality fabric which it produces; knitters, on account of its simplicity, its easy running, its few repairs, and for a good many other technical reasons. The proof of this is the large number of "David Richter" machines which are running in this country to-day.

The new type "Model 1909" machine contains quite a few and important changes from the old style machine. The thread carrier arrangement differs from the old one, as Richter has done away with the brass tube carrier arrangement. This new type "Model 1909" is built with the so-called "double patent" with two spindles; one for the thread carriers, and one for the narrowing apparatus.

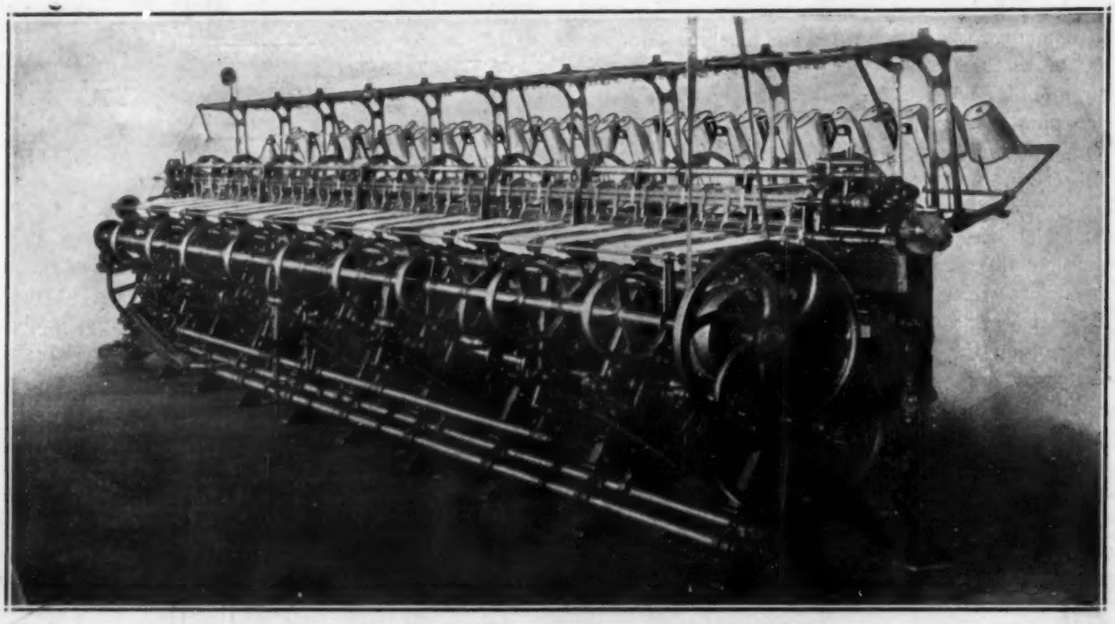
David Richter's Full-Fashioned Hosiery Machine.

The thread carrier rods are so arranged that they strike at the lower part of the spindle-box and their giving way is, therefore, impossible. The carrier rods of aluminum metal, or rods with holes through as usually used in order to avoid the jar, when the carrier rods strike at the ends are, therefore, not necessary.

The Richter machine has always been known for the practical arrangement of its shafts, which gives the machine an easy and quiet movement, which makes it so well liked among knitters. In general, in constructing the "Model 1909" machine, David Richter Inc. have aimed to build as simple a machine as possible, without depriving it of its efficiency and they have succeeded. The simpler a machine is in construction, the easier it is to operate, the less it gets out of order, and the less repairs it requires. These are reasons which a judicious manufacturer considers. David Richter Inc. are represented in the United States and Canada by E. O. Spindler, Rooms 520 to 522, 350 Broadway, New York City.

WOLFGANG RICHTER'S FULL-FASHIONED HOSIERY MACHINE.

The accompanying illustration shows the new full-fashioned hosiery machine built by Wolfgang Richter, 522 N. Fourth St., Philadelphia, Pa. The machine is built with eighteen knitting beds and embodies the principles of the well-known "Cotton" type of full-fashioned machines. This machine derives its name, "full-fashioned," from the fact that the stockings as knit by it are automatically shaped without varying the length of stitch. The work on this machine is flat, and each knitting head represents a complete unit for knitting a stocking. A full-fashioned stocking is easily identified by the fact that it is necessary to unite the edges of the flat web by a seam extending down the back of the leg, and by another seam extending under the bottom of the toe, foot and heel. The advantages of full-fashioned stockings consist principally in the fact that the stocking is shaped by narrowing the web due to the dropping of stitches automatically and as the knitting progresses to conform to the contour of the leg and foot, which insures a perfectly fitting stocking. Furthermore, spring beard needles are used on full-fashioned hosiery machines which do not deprive the yarn of any of its elasticity, since the latter is subjected to very little strain during the knitting operation. The stockings thus produced have the maximum amount of elasticity, which is not obtained on other machines. The underlying principles of this machine for the production of a knitting stitch, consist in the fact that the spring beard needles are rigidly held in a needle bar, which receives a compound motion by having different levers connected to it work on a double fulcrum, said levers being actuated by cams on a shaft extending the entire length of the machine. The needle bar may thus be given a horizontal



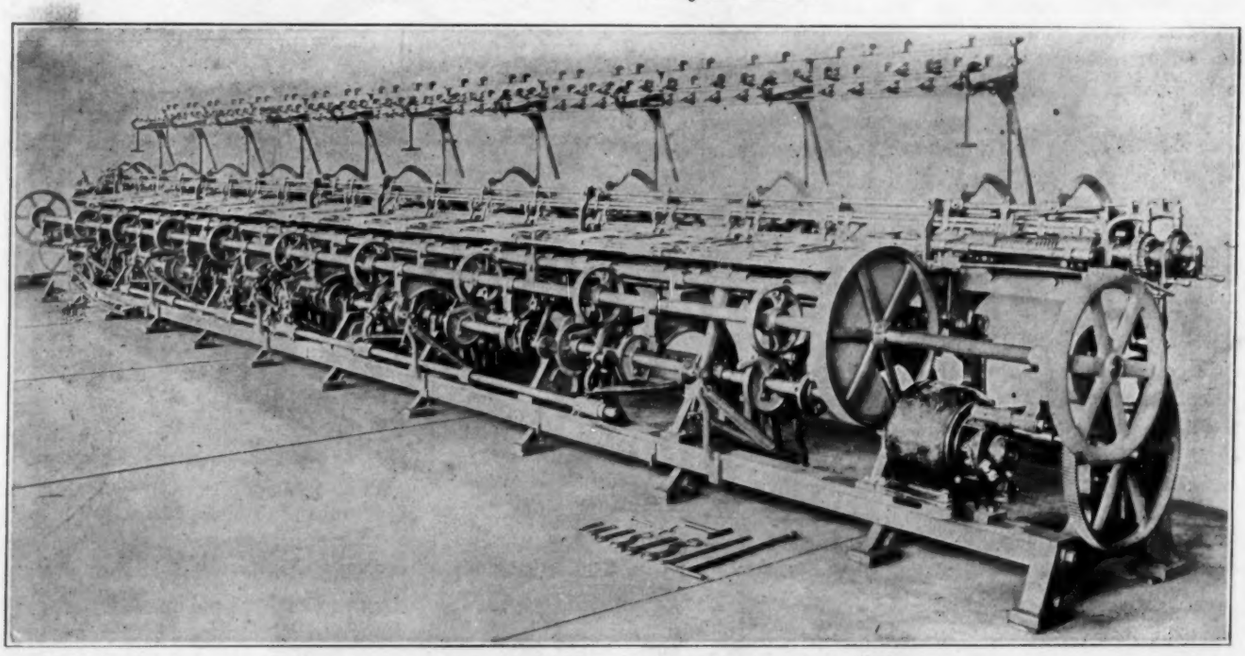
Wolfgang Richter's Full-Fashioned Hosiery Machine.

and a vertical motion. The sinkers that work in connection with the needles are also actuated by levers to give a vertical and horizontal movement, and by a proper combination of these movements the stitch is produced. Thread guides are used which are moved horizontally in unison to feed the yarn at the proper time. Mr. Richter, who has been engaged in building knitting machines almost all of his life, has embodied many new features in this latest machine. The cast-iron bar has been eliminated, and shafts substituted throughout the entire length of the machine. The machine is fully covered by United States patents. The needle bar and head rail are made of the same kind of steel, so that they are equally affected by changes in temperature.

The two side racks for narrowing the stocking have been simplified in construction and are much more rigid than in previous machines. All parts of the machine are made on well constructed jigs, which assure nice adjustment.

TEXTILE MACHINE WORKS' FULL-FASHIONED HOSIERY MACHINE.

The accompanying illustration shows a full-fashioned hosiery machine, manufactured by the Textile Machine Works, Reading, Pa. It has 18 sections and is built on the well known "Cotton" principle. Each section is a complete unit in itself, and knits stocking blanks in the flat form, but all of the sections work in unison and a single pattern mechanism controls the entire machine. There are two distinct mechanisms for each section, namely, one for making the stitch, the other for shaping the fabric. Each one is controlled by its respective set of cams on the main shaft of the machine, the latter being moved endwise at the proper time and to bring the different mechanisms into operation at the proper time. The principal parts of the mechanism for producing the stitch are the needle bar, which holds the spring needles and which is doubled fulcrumed, so that it has both a horizontal and a vertical movement at the proper time; jack sinkers which are used to aid in the formation of loops, said sinkers being worked in and out between alternate needles, the horizontal movement that sends the sinker in between the needles being given by a striking jack. There is one for each sinker, said striking jacks being operated successively by a sliding slur cock, which is moved horizontally and parallel with the needles. The movement to send the jack sinker out from between the needles is given by a catch bar which is controlled by two levers whose operation is controlled by the cams on the main shaft. The dividers are placed alternately between the jack sinkers to work between the needles not taken care of by the jack sinkers. However, the jack sinkers only are operated by the striking jacks. The jack sinkers form loops over every two needles and the dividers between the jack sinkers divide the loops, so that each needle receives an even sized loop. There are projections at the front end of the sinkers which are known as the nib and nose, the former being used for forming the loop, and the latter for separating the new loop from the old during its formation and until it has been drawn through the old loop. The dividers are moved forward and backward between the needles by the catch bar, which, as mentioned are also used to give the backward movement to the jack sinkers.



TEXTILE MACHINE WORKS' FULL-FASHIONED HOSIERY MACHINE.

The operation of the parts in the production of a course of stitches is as follows: We will consider ourselves as standing in front of one of the sections; the spring needles in the needle bar face the back of the machine. The jack sinkers and dividers are located in back of the needles, with their working ends pointing towards the front of the machine between the needles. Previous to feeding the yarn the jack sinkers and dividers project slightly through the spaces between the needles and rest above the previous stitches on the body of the needles to hold the work down. The yarn carrier is located just behind the needles and above the jack sinkers and dividers, and deposits yarn in the nibs of the jack sinkers which constitute a small cut out portion for holding the thread. The hooks of the needles at this time are at their highest position. The horizontally moving slur cock then acts to push the jack sink-

ers into their respective spaces between alternate needles and loops are formed on every two needles. The catch bar then acts to move the dividers into their respective places between the needles, and the one loop about two needles is divided, thus making two loops, or one for each needle. In order to make the loops equal, the needle bar is moved slightly toward the front of the machine, which action loosens the double loop sufficiently to enable the dividers to form equal loops with the sinkers. The loops on each needle having thus been formed, the needle bar is actuated downwardly by cams so that the loops slide up into the hooks of the needles. A continuation of the downward movement brings the beards of the needles against the presser bar, which presses the beards into small lots on the bodies and thus close the hooks so that by the continued downward movement of the needles, the old stitches on the bodies of the needles may slide up over the hooks and be cast off over the new loops. At the same time the needle beards are being pressed, the jack sinkers and dividers are retracted to allow the old loops to be cast off as described. After the old loops are cast off, the cams actuate the levers to raise the needle bar and consequently the needles, and the new loops slide down onto the bodies of the needles. At this time the jack sinkers and dividers are again brought forward slightly to project between the needles and rest on the new loops, in order to hold the work down. This completes the cycle of operation for producing a course of stitches and the jack sinkers are then in position to receive another course of yarn for making a new course of stitches.

BEATTIE LOOPERS.

These machines are used for looping or closing the toes of hose and half hose made on seamless knitting machines. The Beattie Mfg. Co., Cohoes, N. Y., manufactures several different styles and sizes, such as the single stitch looper, patent single elastic stitch looper, patent through and through switch looper, patent under and over or double stitch looper, etc. The gauge of the looper is designated by so many points that are used for different numbers of needles on which the hose or half hose were made. The following number of needles on knitting machines ranging from 2½ to 4 inches require these loopers:

60	to 72	needles on	7-Point	Looper
72	" 84	"	9	"
84	" 96	"	10	"
96	" 108	"	12	"
108	" 120	"	13	"
120	" 132	"	14	"
132	" 144	"	15	"
144	" 160	"	16	"
160	" 172	"	17	"
172	" 196	"	18	"
196	" 208	"	20	"

Especial attention is directed to the patent single elastic stitch looper shown in the accompanying illustration with an improved tension, allowing as much elasticity as the under and over and through and through stitch machines. The double stitch machine has to be run at twice the speed to accomplish as much work as the single stitch looper with the improved tension. This tension is so constructed that it vibrates back and forth and throws the thread slacker than the regular tension, which is rigid. This give the stretching qualities to the garment without breaking the thread. The simplicity of the tension in its construction requires no more care or attention than the old style. All machines are equipped with patent points and rings which prevent the needle from striking the brass between the points and thus lengthens the life of a machine. They hold very firmly.

The patent adjustable cam can be adjusted instantly to the hook and needle, and in a manner that requires less tension on the thread. It is made in two parts, either of which can be renewed at a comparatively small expense. All cams are carefully milled on jigs and they are accurate. The adjustable needle bar is made in two parts, carefully fitted to-

Beattie's Single Elastic Stitch Looper.

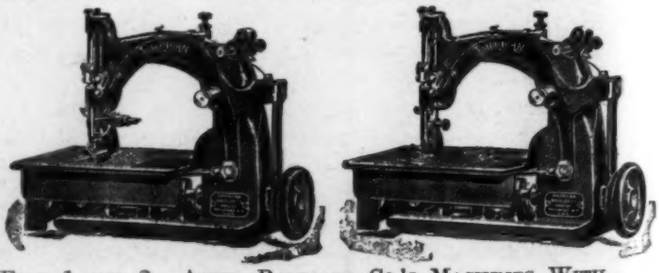
gether, which allows the needle to be raised or lowered without readjusting the cylinder. It also overcomes the necessity of bending the needle up or down to conform with the points, which prevents broken needles. The automatic shaft brake is a friction brake which is put on the lower shaft, and positively obviates drop stitches. All the machines have tight and loose pulleys, which prevent the machine from starting and stopping suddenly, and therefore do away with the jarring.

THE AMERICAN RAVELLER CO.'S MACHINES.

The American Raveller Co., Philmont, N. Y., manufactures several styles of sewing machines for finishing underwear and knit goods, and different types of ravelling machines, for closing the toes of hosiery and for making seams on full fashioned underwear. It is claimed that the sewing machines run at the fastest speed of any machines on the market and make as high as 3,000 stitches per minute with practically no noise. The machines are built in a very durable manner, and the quality of work produced is excellent. All parts of the machine are interchangeable. Special attention is called to following machines:

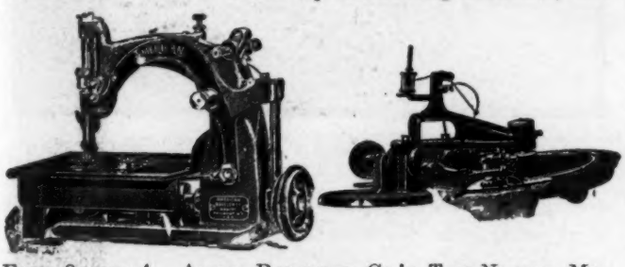
SEAMING MACHINE.

This machine is shown in Fig. 1 with the Traver's shear trimmer attachment. This is a single needle seaming ma-



Figs. 1 and 2. Amer. Raveller Co.'s Machines With Traver's and Dewees' Trimmers.

chine for trimming and sewing all kinds of knit goods and hosiery. It is claimed that this machine has no equal in performing the first operation of sewing in trimming underwear and hosiery. The two operations of sewing and trimming are performed simultaneously with great precision and accuracy, the trimmer cutting very close to the stitches and making a very clean edge. The machine operates noiselessly and at a speed of 3,000 stitches per minute. There are thousands of these machines in use. Especial attention is directed to the Traver trimmer, which is a perfect shear, making a clean, smooth cut edge. It does not pull nor stretch the cloth. It is claimed that it will trim closer to the needle than any other trimmer on the market which has the advantage of saving a great amount of waste. A differential feed is not required to partially deal with the stretch of the fabric. It is said to be superior to the toggle trimmer for the reason that it is easier on the machine and can be repaired by any ordinary mechanic. This trimmer is also adapted to be used in connection with the Union Special sewing machines, and



Figs. 3 and 4. Amer. Raveller Co.'s Two-Needle Machine and Wishbone Hosiery Raveller.

many of them have been attached by the American Raveller Co.

TWO NEEDLE SEWING MACHINES.

This machine, as shown in Fig. 3, is used for band stitching and covering seams, and for two row stitching, sewing lace on necks of underwear. With a slight alteration it may be converted into a two line machine for two row stitching.

WISHBONE HOSIERY RAVELLER.

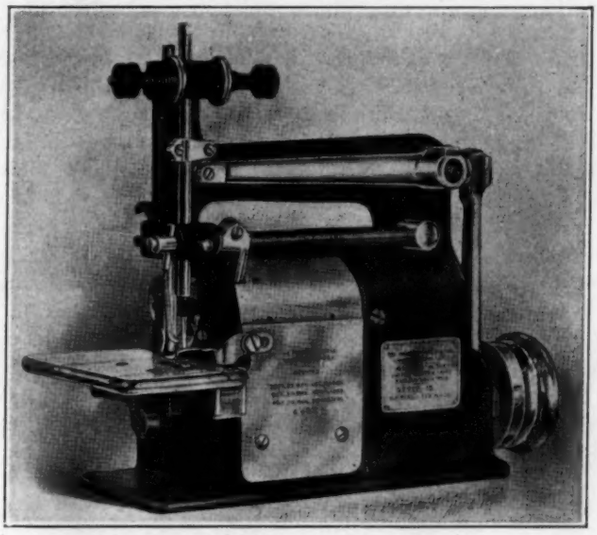
This machine, as shown in Fig. 4, is used in connection with any circular looper for ravelling the toes of hosiery. It is claimed that the production of the looper can be increased from 35 per cent. to 50 per cent. by the use of this attachment, and it will perform the work more accurately and neater than an operator can ravel by hand. This attachment finds extensive use in the industry, having been on the market many years and is constantly adding to its reputation as a money maker.

THE MERROW SEWING MACHINES.

The Merrow Machine Co., Hartford, Conn., build a great variety of high speed machines, the most notable types of which are included in the following list:

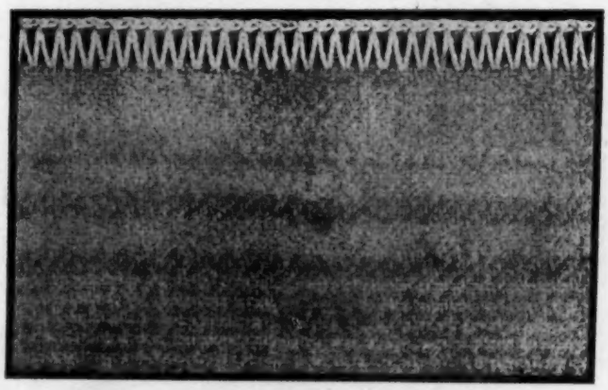
Two thread plain crochet machines.
Single thread blanket hemming machines.
Two thread shell stitch machines.
Two thread overedge finishing machines.
Three thread overedge finishing machines.
Two thread trimming and overseaming machines.
Three thread trimming and overseaming machines.

This company has exclusive control of numerous inventions for which letters patent have been granted, which also include many products and methods. All of these machines are especially designed and constructed for continuous running at high speed, and all parts are inter-



Merrow's Style 15 Plain Crochet Machine.

changeable, the working parts being made of fine steel hardened and ground to fit. The list includes machines for operating upon a great variety of material, ranging from tops of boots more than half an inch thick to the finest chiffon. Some of the stitches are more than one half inch deep, made from the coarsest yarn, while others are hardly one sixteenth of an inch deep, made from the finest silk. Some are very ornamental and others are almost invisible; some are made over a cord or tape and others over a hem. The overedging machines are used for edge finishing only, while others are made for sewing together two or more pieces of fabric with an overedge stitch, either with or



Merrow's Two-Thread Plain Crochet Edge.

without cutting off the edges simultaneously in advance of the sewing.

STYLE NO. 15 PLAIN CROCHET MACHINE.

This machine, illustrated in Fig. 1, produces a two-thread, plain, crochet edge finish to a depth of about one quarter of an inch. A sample of the work is shown in Fig. 2. This finish may be made very elastic or quite firm with little elasticity and any immediate degree of elasticity of edge finish may be produced. Two threads of different shades, materials, or sizes may be employed to

produce a great range of effects. The roughest of cut edge can be thus perfectly covered and protected with an economical expenditure of finished material, as only one thread is carried by the needle, the supplemental thread being enchained with the needle thread along the edge of the material. By dispensing with the supplemental thread, this machine will produce the single thread crochet finish, and this can ordinarily be done without readjusting the machine. A special adding attachment can be supplied with this machine, which is adapted to facilitate building one course upon another until the desired width is attained. Various forms, such as caps, Tam O'Shantas and slippers, may be made in this manner.

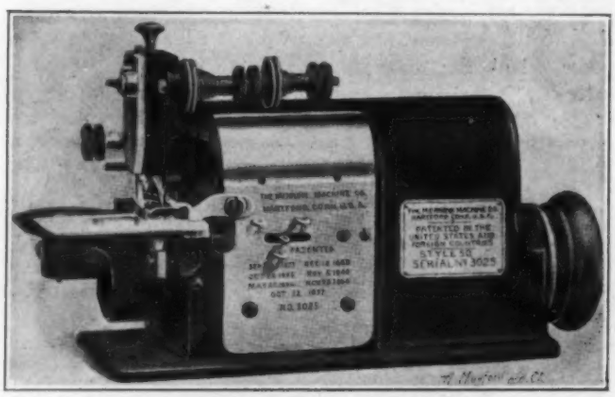
Leggings are "footed" by the style No. 15 machine with the adding attachment, by building course upon course in proper form. The style No. 15 machine is adapted to run from 1,200 to 1,500 stitches per minute, and as the feed is from four to six stitches per inch, the production is very great.

STYLE NO. 50, THREE-THREAD EDGE FINISHING MACHINE.

Style No. 50, high speed machine represented in Fig. 3, produces the three-thread overedge finish, which is claimed to be one of the best edge finishes ever originated, and especially adapted for finishing raw edges of knit goods. Special provision has been made in this machine to facilitate finishing the edges of small cuffs and other tubular goods. It is provided with devices designed to control the edge of the fabric so that when finished it will not be pouted or extended.

The finished product by this machine is about one-eighth of an inch in depth.

Fig. 4 is a full sized illustration of the edge finish produced. Machines can be provided with guides to introduce



MERROW'S CLASS 50 THREE-THREAD MACHINE.

a cord or tape to be covered by the edge finish at one operation.

SETTING THE NEEDLE.

No. 3AC needle or No. 5C needle is used. The needle and needle plate must correspond. If a needle that is too large for the needle hole in the needle plate is forced one time through the hole in the needle plate the latter will be seriously injured. The needle should be set with the rear of its shank projecting very slightly from the needle carrier. In setting the needle use a gauge which indicates the distance from the left hand face of the machine frame to the center of the needle.

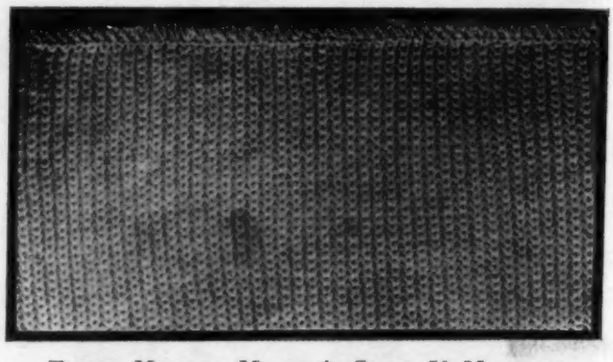
THE TENSIONS.

For the usual finish, considerable tension upon the needle thread is required, with light tension upon the upper looper thread and medium tension upon the lower tension thread to lay the upper looper thread upon the upper face of the fabric, the needle thread upon the lower face and the lower looper thread upon at the edge.

Great variations in results may be attained by changing the relative tensions upon the threads.

THE NEEDLE CARRIER.

The needle carrier must be perfectly free to swing upon the stud, but must have no lateral movement. This adjustment is accomplished by first loosening the needle carrier stud set-screw which is located in the frame of the machine



FINISH MADE BY MERROW'S STYLE 50 MACHINE.

directly back of the center of the needle carrier stud, this screw being accessible from the rear of the machine outside. If this is neglected in a single instance the machine will be injured. The needle carrier screw should be screwed in or out very delicately until the proper adjustment is attained; then tighten the needle carrier stud set-screw and test the needle carrier again. When replacing this stud after removing it, clean it thoroughly, oil it and be careful to enter it properly so as not to cross the threads and thereby injure the holes, as the threads are very fine.

THE PRESSER FOOT.

The amount of pressure of the presser foot upon the fabric is adjustable by first loosening the small set screw at the right side of the upper part of the head and adjusting the milled head thumb screw at the top of the machine, always tightening the set-screw finally. The set-screw may be so adjusted as to cause sufficient friction on the thumb screw to hold it and yet permit turning it by hand, which is convenient if frequent adjustments of the pressure of the presser foot should be desirable under unusual conditions.

THE THREADS.

The threads of whatever material should be as free as possible from knots and bunches, even in size and twist, and not too hard twisted. Never undertake to run the machine with the thread wound upon a two-headed spool which must revolve. The thread should be wound upon cones, which should stand vertically.

From 1898 to 1908 the world's greatest wool production decreased from 2,750,000 bales to 1,750,000; in the same period the world's cotton supply increased from 10,304,000 bales to 17,782,000 bales.

Texas produces about 28 per cent. of the total cotton crop, and has a total acreage of 9,700,000 acres planted out of the grand total of 31,000,000 for the entire belt.

METROPOLITAN SEWING MACHINE.

Within the past few years a new line of sewing machines have been developed and perfected by the Metropolitan Sewing Machine Co., Nyack, New York, who manufacture a complete line of flat bed machines for the knit goods and hosiery trades, comprising machines for producing various types of chain and overstitch systems. The machine shown in Fig. 1 gives an idea of the "collarette" machine. The method of putting on collarettes in one operation by mechanical means was the company's pioneer invention, though others are selling machines of similar type for this purpose. Up-to-date manufacturers who are making high-class goods use the Metropolitan machines because they give a perfect and uniform shape to the neck.

Another "Metropolitan" machine of special interest is the one for sewing lace on garments and attaching drawer seats. A sample of the work is shown in Fig. 2, the top sample showing the stitch on the face, and the bottom sample showing the appearance on the back. The machine embodies a double stitch forming mechanism, one being located below the work plate, which makes a stitch that covers the bottom edges, and the other being enclosed in the presser foot for making a covering stitch on top and linking the two in a manner that makes the stitch thus produced very desirable for the classes of work described. The top stitch mechanism compares in size with a silver ten-cent piece and is one of the most important features of this machine, the thread carriers being positive in their movements around the needles to cross the threads at each stitch. The motion

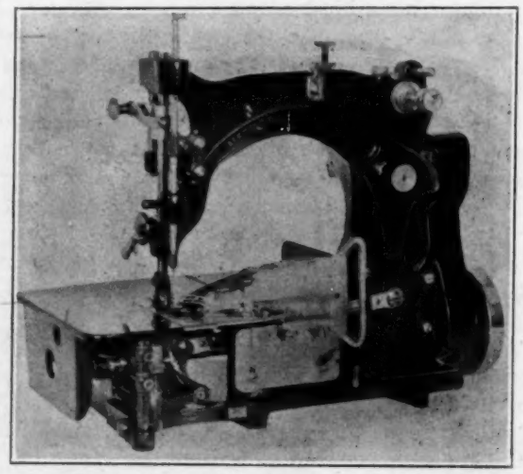


Fig. 1. Metropolitan Collarette Machine.

is rotary reciprocatory, and the parts are enclosed, and out of the way of the hands of the operator, which assists greatly the rapid handling of work. Various forms of guides are applied to this presser foot, according to the character of the work produced. As for instance, in the operation of drawer seating the patch applied to the top of the garment is easily guided so that the stitch properly covers the edge by means of a guide which carries it between the needles, the same being visible to the operator until it is covered by the stitch.

This machine handles four threads—two in the needles and two in the thread carriers—all being visible to the operator until they reach the point of stitch formation. It is very simple in construction and operation, and embodies all of the up-to-date refinements in sewing machine mechanisms. It is a very easy machine to keep in good order.

This company also builds a number of overstitching machines, which produce very handsome work. The fac-

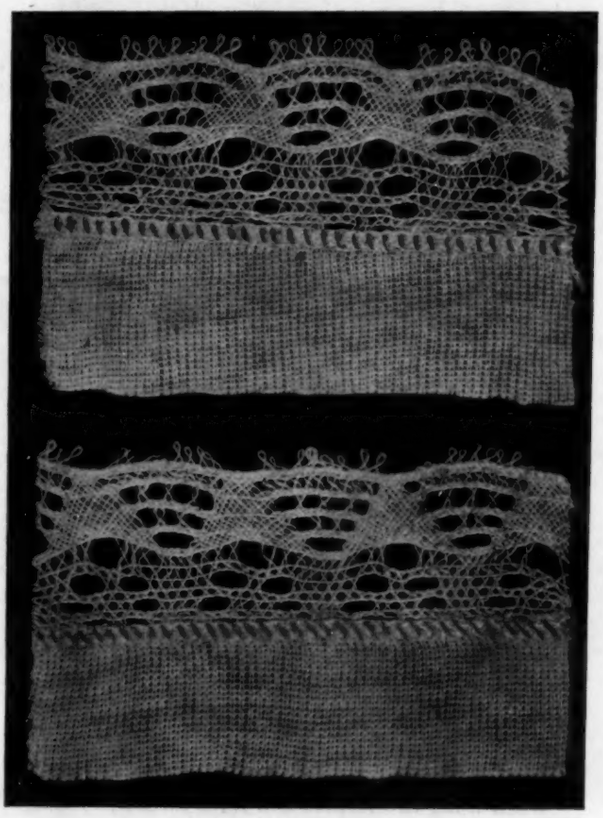


Fig. 2. Sample Showing Metropolitan Cross Stitch Work.

tory and main office of the company is located in Nyack, N. Y., with branch offices in New York City, Brooklyn, Troy, Amsterdam, and Utica, Boston, Mass., and Philadelphia, Pa.

SINGER SEWING MACHINES FOR UNDERWEAR.

This machine as shown in the illustration is made by the Singer Sewing Machine Co., New York City, and is used for trimming and overedging knit goods in connection with the finishing of underwear. It is used for hemming, seaming, putting on cuffs, edging arm holes, sewing on borders, edging necks, collarettes, and bottoms of garments. A sample of the work performed is shown in Fig. 1, showing both a seam and an edge produced with the overedge stitch. It completes the work entirely, without any after processes, making a smooth, firm seam or edge. One of the practical features of the machine is the high speed obtained, owing to its special design in which the few vibrating parts are small and light, and the motions regular and smooth. It is stated by the manufacturers that this machine will produce a greater amount of satisfactory work than any other machine used for the same purpose. It is generally fitted with a trimmer, looper and spreader for making the two-third overedge chain stitch which trims, seams and covers at one operation on practically any variety of knit goods. When fitted with two loopers and other parts, it makes a three-

thread stitch, forming either a single or double purl, which is very desirable for making fine edges.

The trimmer is made easily adjustable so that any desired bight on the goods can be obtained. An auxiliary feed with its presser-foot acting upon the seam and the stitch serves to bring the material out flat and without a pulled edge. The degree of pressure on the feed can be adjusted for different kinds of work by means of an adjusting screw at the back of the machine.

When using a looper and a spreader for making the two-thread stitch, the take-up for the needle thread should be set to the left, in order to draw all of the thread on the downward stroke. The small take-up on the looper lever

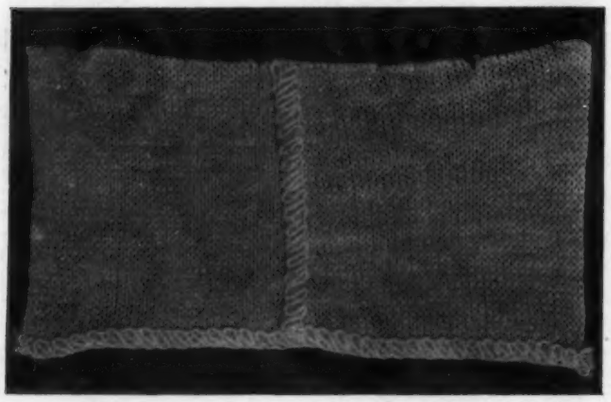


FIG. 1. SAMPLE OF "SINGER" OVEREDGE SEAM AND EDGE.

should be set to the right, in order to draw the greater part of the thread on the downward stroke.

When using two loopers and three threads, to make the single purl stitch, the needle thread is drawn tightly to the material to make a firm seam when two pieces are stitched together. A very narrow bight can be used without danger of the seam pulling out. In adjusting the machine for this stitch, the needle thread is left out of its take-up, the thread leading directly from the tension ratchet to the thread guide on the arm head, with a tight tension used; the small take-up on the looper lever at the left is then far enough to the right hand to draw all of the thread on the downward stroke. The tension on the left hand looper thread is made very light. Sufficient tension is used on the right hand looper thread to bring the purl to the edge.

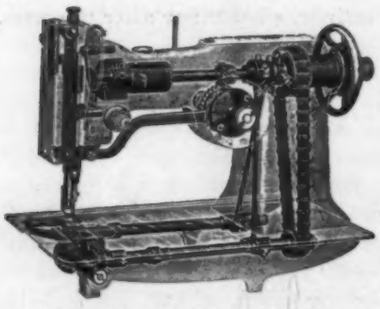
To make the double purl stitch, using two loopers and three threads, the machine is threaded in the usual way, setting the needle thread take-up so that it will draw most of the thread on the downward stroke. At the same time it is necessary to use a medium or light tension for the thread. The small take-up on the looper should be set as far as it will go to the shaft, or turned at right angles, thus bringing the hook portion toward the operator. The left hand looper thread should have a tight tension, while that on the right hand looper thread should be strong enough to bring the purl to the edge.

A blind stitching hem as used on knit garments, stockings, etc., may be made on this machine when the latter is provided with a welt guide, a front feed dog, throat-plate and presser-foot.

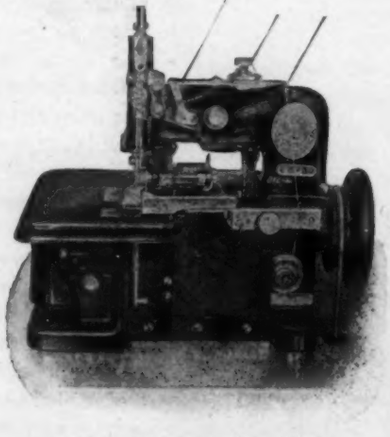
SINGER ZIG-ZAG STITCH MACHINE NO. 107-W.

No. 107-W is a style of machine for making an overseaming and zig-zag stitch, the latter being used extensively for applying the patch to the seat of men's drawers and similar operations where a lock stitch is essential. A sample of the work made on the machine is shown in Fig. 2. The stitch presents the same appearance on both sides of the garment. The construction of the machine embodies the rotary system, which is used to drive the needle bar frame pitman, thus assuring durability at a high speed of operation. It can be successfully operated at 2,500 stitches per minute. The needle bar carrying the needle at its lower end works in a frame piece hinged at the top as shown in the illustration of the machine. The needle bar is given a lateral reciprocating motion or throw across the line of feed, by means of an eccentrically driven pitman, the driving arrangement from the top horizontal shaft being clearly shown in the illustration.

After each movement of the feed, a stitch is formed at the end of each throw, that is, a stitch is made when the needle bar is in its outward and again when it is in its inward position. This method causes the stitches to appear in zig-zag formation. An overseaming stitch can be made by having one stitch to be taken on the material and the other over its edge. The hook on the under side of the driving mechanism is driven laterally back and forth across the line of feed, to operate back of the needle and through the thread loop formed by the needle. The length of stitch is regulated through the feed, and may be adjusted by turning the feed regulating spindle head located to the right of the balance wheel. The width of throw or bight of stitch is regulated by means of the spindle head or the front part of the arm, the maximum width of throw obtainable being 7/32 of an inch.



SINGER MACHINE NO. 107-W-1.



SINGER MACHINE NO. 81-3.

SINGER MACHINE NO. 62-10.

Among the other Singer machines used in the production of underwear, are:

No. 62-10 is used for producing a double thread elastic chain stitch, a sample of which is shown in Fig. 3, the top sample showing the stitch on the face, and the lower sample illustrating the appearance on the back. The machine has

FIG. 2. SAMPLE OF "SINGER" ZIG-ZAG STITCH.

two needles, one looper, and is used for covering seams, for necking and ornamenting knit underwear.

No. 24-26 makes a single thread elastic chain stitch, 8 to 30 stitches to the inch, and can be run at a speed of 2,500 to 3,000 stitches per minute. It is especially adapted for seaming on knit goods.

No. 88-1 is a rotary hook, lock stitch sewing machine for attaching textile facings to knit goods at a speed of 3,500 stitches per minute, with neither noise nor vibration. The hook makes only two revolutions to one of the arm shaft, so that the machine will wear longer, it is claimed, than any other approaching its speed.

No. 79-1 is used for tacking drawer straps; is adjustable for making the bar tack from ½ to ⅞ of an inch long, and 1/16 to 3/16 of an inch wide, the last two stitches fastening the thread and the automatic cutters trimming it close to the tack both at the top and the bottom.

No. 52-32 has four needles and four hooks for buttonhole facings; has strip folders, upper and under, to throw out for folding the raw edges of facing and lining, and stitching same upon knit undershirts at one operation. The needles are gauged 3/16, 1⅛ and 3/16 inch apart.

No. 71-42 is the latest work-producing machine for making high grade buttonholes. It makes a "whip" stitch and cuts both threads and buttonhole automatically after stitching.

No. 68-7 is used for attaching either two or four hole buttons. It makes eleven cross and three tying stitches. The upper thread is drawn below and both ends are cut off close to the material, so that no ends of thread are left on the right side of the button.

For the fiscal year 1909, the United States exported to Canada raw cotton valued at $6,400,000; cotton manufactures valued at $3,500,000. Raw cotton formed the fourth largest item exported to Canada.

WILLCOX & GIBBS' "OVERLOCK" MACHINE.

The "overlock" stitch is a very elastic and efficient covering or wrapping stitch, which makes it valuable for edge-finishing, and selvaging as well as for seaming. When used for seaming the result is an evenly finished and perfectly elastic connection of the two parts of the garment, the edges of which are neatly covered and protected from wear. The elasticity of this stitch is obtained by laying so much of its thread, both upper and under, across the width of the seam. A diagram of this stitch is shown in Fig. 1. It must be borne in mind that the diagram is greatly enlarged, and the positions of the several threads are considerably distorted in order to show more plainly their relation to each other. Referring to the figure, the upper, or needle thread, 1, lies partly on the back of the fabric as illustrated by the dotted lines in the top diagram, and appears on the face in a series of loops which form a continuous straight line A and B. The looper thread 2 lies on the upper surface entirely.

In speaking of the under thread 2 in this stitch, the one which is carried by the looper is referred to but in reality this thread is finally laid on the face of the material. It will also be noticed that a greater part of the upper or needle thread 1 is on the under side, so that as the two threads are finally deposited in the seam they are exactly reversed from the positions which they occupy in the machine. Another feature of this stitch, and one which gives it the great elasticity, is, that only a very small proportion of either of its threads is laid in a line parallel with the seam itself; on the contrary, the two threads are continually led across the seam from the needle line to the edge and back again in a zig-zag fashion.

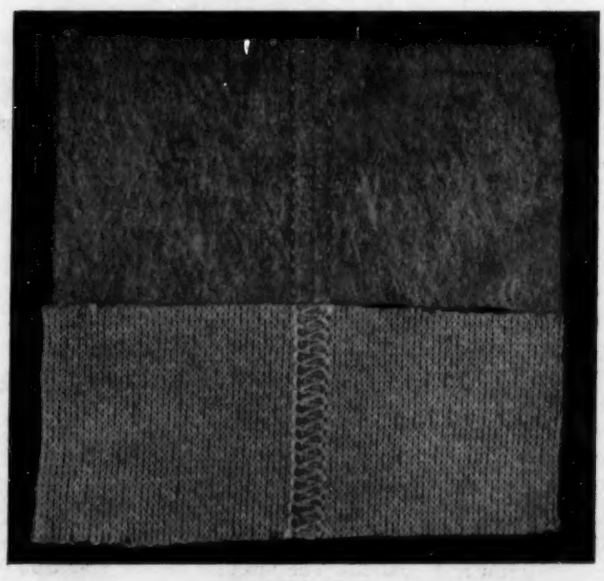


FIG. 3. SAMPLE OF SINGER DOUBLE THREAD CHAIN STITCH.

In the diagram the needle thread 1 appears as a straight line on the face, but after passing through the fabric to the back it is drawn by the looper and looped or laced on the seam's outer edge with the under thread 2 or, as it appears in the finished seam, with the thread on the face. The looper thread 2, also, is almost wholly crosswise of the seam line. It is plain, therefore, that this manner of laying the threads must necessarily produce a seam which can be

stretched to the utmost limit of the material without breaking the threads, and is at the same time a most serviceable covering of wrapping for the cut edge of the fabric.

An advantage which the "overlock" stitch has, is that the thread may be used directly from large spools or cones, because, the spool end of the looper or under thread 2 is never passed through the needle loop, but the two threads are laced or locked together from stitch to stitch, similar to a knitting stitch or crocheting. This obviates the necessity of bobbins for the under thread 2 on which may be wound only a limited number of yards, owing to the fact that the

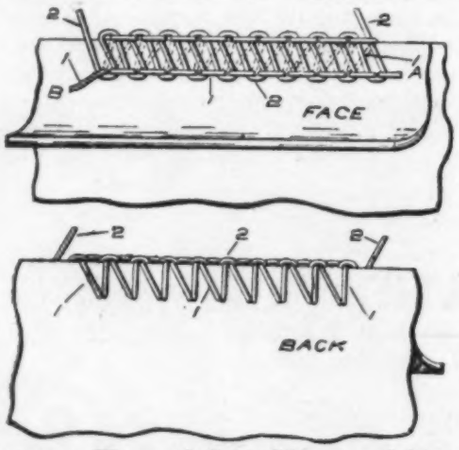


DIAGRAM OF WILCOX & GIBBS "OVERLOCK" STITCH.

thread, bobbin and bobbin case must be passed entirely through the needle thread loop for each stitch.

In the "overlock" stitch only a very little more thread is drawn from the needle than is actually required to make the stitch when it is finally in its position, so that no unused surplus must needs be taken back through the eye of the needle by the moving eyelets. For this reason the thread is not served back and forth so much, and thereby frayed or weakened before finally laid in the stitch.

THE "OVERLOCK" MACHINE.

The machine for making the "overlock" stitch is manufactured by the Willcox & Gibbs Sewing Machine Co., New York City, and is shown in Fig. 2. The machine is designed to trim, join and cover the seam in one operation. In other words, the "overlock" machine makes (1) the "overlock" elastic seam with its strong double thread stitch and smooth-covered finish; (2) the "overlock" elastic concealed stitch hem, with no stitches showing on the right side. It is a substantial reproduction of the full fashioned or turned down hem; (3) the "overlock" elastic overedge for producing a strong artificial selvage of neat appearance, the elasticity of the stitch being equal to the full stretch of the goods; and (4) the "overlock" tailor-made seam (by means of the feller) across the shoulders, around the arm-holes, and on cuffs and gussets. The machine makes over 3,000 stitches per minute and is used for seaming, hemming and overedging flat, ribbed and fancy underwear and hosiery.

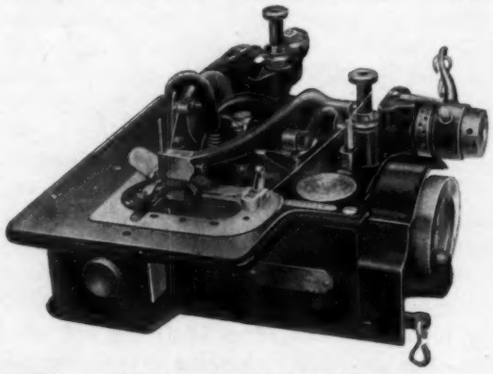
All of the operating parts of the machine are mounted on a single casting or frame, which is hinged to a plain box casting, the latter serving as a rigid base or support and also as a receptacle for the oil which drips from the bearings, thus preventing an oil-soaked work table. This arrangement of the various parts makes them readily accessible both on the top of the frame and on the under side. All shafts and studs are hardened and ground, and their bearings brought to standard gauges of a perfect interchangeable system.

The machine has proven valuable in various lines of manufacture and many beautiful and highly useful results have been produced with it. Besides being used in connection with underwear for seaming, edge finishings, and to make the concealed stitch hem on shirt bottoms and the tops of hosiery, it is also used on lace curtains, lace insertion, velvets, silks, belts, etc.

There are practically no adjustments to be made on the machine, as several of the functions are positive and permit of no change whatever, the only possible adjustments being those for the length of feed or stitch, the width or bight of seam or overedge, and the lower trimmer blade, and to a limited extent the tensions. The take-up and pull-off mechanisms are positive and are not changed.

There is probably no one feature in a sewing machine which is so extremely sensitive or which if changed, even very slightly, produces poor results so quickly as the tensions. It is no uncommon occurrence to trace the cause of poor work to these parts, and it is naturally an advantage to have a construction which makes it possible to permit their range of action. When the difficulty is traced to the tensions, the first step should be to draw the discs apart and blow the lint out, so that the discs may come closer together, and not be hindered from pinching the thread properly. This trouble represents practically the only difficulty that should be found with the tension mechanism. In this "overlock" machine the tension nuts are restricted in their movements to less than one full turn, and it is, therefore, evident that the possibility of error in adjustment is very small.

This small range of adjustment is available from the fact that the pull-off and take-up mechanisms are constructed so that any amount of tension that may be necessary to meet the different requirements of a stitch, from



WILCOX & GIBBS "OVERLOCK" MACHINE.

light to heavy fabrics, is found within this small range of tension adjustment.

The adjustment for the width of trimming or bight has been made semi-automatic, that is, it is operative within certain predetermined limits as required, and while the machine is in operation. This is accomplished by means of a treadle connection to the trimmer adjusting arm, which when actuated serves to alter the positions of the trimming parts in relation to the line of needle punctures.

This feature of the machine enables an operator to complete a garment with seams which vary in length as required on different parts of the fabric. For example, a seam which is made along the side of the sleeve or drawer

leg will be stronger than one made across the shoulder of a shirt. In the first instance, the stitching is with the wale of the goods or lengthwise of the fabric, where there is small tendency for the knitting stitches to ravel out, so that a minimum width of seam or trim can be employed. In seaming across the top or shoulder, and around arm-holes or gussets, the stitching is laid either squarely or diagonally across the ends of the wales, where the knitting loops are exposed and extremely liable to ravel if not properly secured; therefore a wider seam is necessary.

When it is desired to use this feature of the machine for changing the width of seam, a thumb-pin is inserted in one of a series of holes in the trimmer-adjusting arm, back of a stationary stop, and when it is against the stop this pin is a limit for the narrow seam. Another thumb-pin placed in a hole in front of the stop, as far away as is necessary to give the required change, will be a limit for the wide seam. In operation, this trimmer-adjusting arm is held normally in position for a narrow seam by a spring, and when the treadle is depressed the trimming parts are moved to the position for a wide seam.

In setting the trimmer blades for seaming, the cutting edge of the lower blade should be adjusted even with the top of the throat plate, or needle-hole piece. For concealed stitch hemming this blade must be a trifle higher, and for both purposes the cutting edge of the upper blade must pass by that of the lower one a sufficient distance to insure clean cutting of the fabric. The position of the upper blade is determined by a stop, so there is small chance for error. It is very necessary to keep the trimming blades sharp, for if they become dull, bad work will result, besides causing annoyance. A trimmer blade grinder is furnished with each plant of "overlock" machines to insure correct grinding of the blades. On the slide of this machine a set of grooves have been milled to fit the respective upper and lower trimmer blades, and when in position the blades are held and presented to the emery wheel so as to give their cutting faces the proper angles.

DYEING, BLEACHING AND FINISHING

WARP MERCERIZING.

(Continued from February.)

PART II.

When the warps are required to be bleached, either to remain white or for the purpose of dyeing, the souring operation is dispensed with; and when they have only to be dyed, the treatment is varied, according to the character of the coloring matter to be applied. Here again the question is sometimes brought forward as to the advantages in more complete thoroughness of mercerization of the warps being gained by bleaching before mercerizing rather than afterwards. Though there is certainly something to be said in favor of such a course of procedure on purely theoretical grounds, practical experience has most undoubtedly shown that these are not borne out, and anything in its favor is overwhelmed with disadvantages that prohibit the bleaching of warps before mercerization for the major part of the class of goods. Bleaching is, therefore, almost always carried out after the mercerization, with but few exceptions. Consequently when intended for bleaching, the warps are not soured after mercerizing, but are washed and sent away in the wet state to the bleaching process.

Many variations are met with in the mode adopted for bleaching, though they all come under one of two heads—machine-bleaching or the steeping method. Perhaps the choice of one over the other is most often controlled by the arrangements that happen to be at hand, and though most successful results are industrially obtained by both of these methods, it would appear that the more rational, and the cheaper, is the steeping method of chemicking. The procedure called for in this is sufficiently well known to our readers. It may, however, be of interest to many to learn of a machine method of bleaching mercerized warps that may be regarded as a decided departure from generally accepted methods, yet which for many years has given most excellent results, not only for whites, but in bleaching for dyeing.

In this instance the chemicking is accomplished by one or two passages, according to the depth of the natural color of the yarn, through a four-compartment machine composed throughout of iron. The first compartment of the diagram Fig. 3 contains a solution of chemic liquor, 6 degrees Twaddell, heated to 200 degrees Fahrenheit; the second a liquor at 4 degrees Twaddell heated to about 100 degrees Fahrenheit; the third and fourth a cold weak chemic.

The warps are caused to pass through this series of compartments at an ordinary rate of speed, and the yarn suffers no injury from this short contact with the hot chemic, inasmuch as the warps leave the machine after passing through cold chemic; are plaited on to wagons and allowed to lie off for a time, being subsequently washed, soured, and washed. Mercerized warps bleached in this way give particularly good results in subsequent dyeing processes, whether by the use of the substantive dyes or the basic coloring matters, invariably admitting of the attainment of most uniform colorings. Naturally enough the whites, when to be dyed with a direct coloring matter, should not carry any trace of acid from the souring operation, and it is, therefore, customary to give a final passage through ammonia or soap before dyeing.

In the case of greys they are left in a favorable condition for dyeing with the direct dyes when not soured after

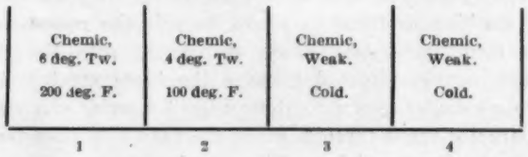
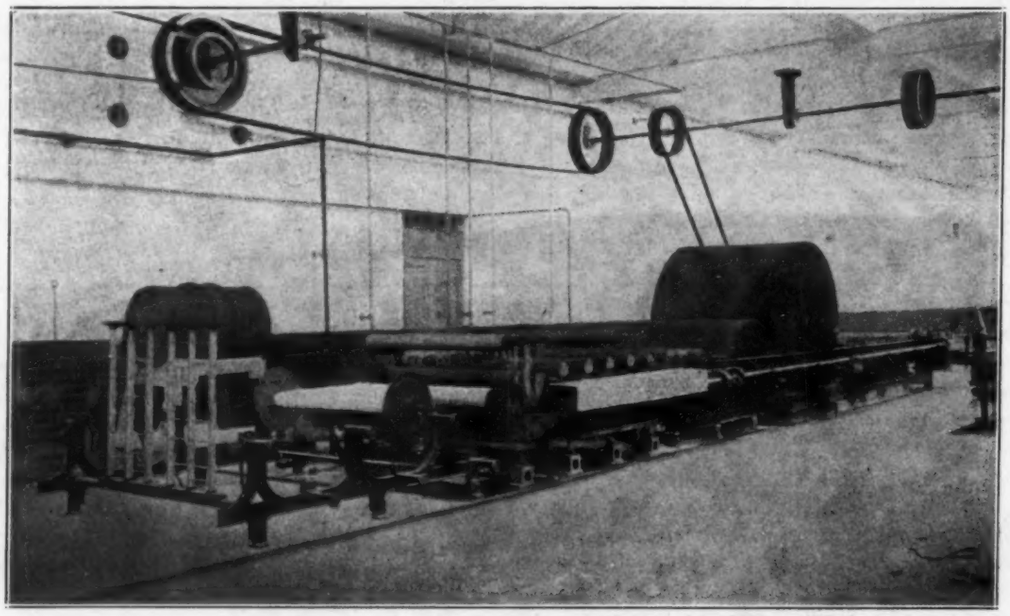


FIG. 3. DIAGRAM OF A FOUR-COMPARTMENT MACHINE FOR BLEACHING.

mercerizing, but for the application of the basic dyes, directly or on mordanted material, all trace of the caustic soda should first be removed by a course of souring, to reach the best results. With regard to the particular nature of the bleaching operation, it is considered in some quarters an advantage to use the sodium peroxide bleach, on the grounds that its alkaline nature exercises no deteriorating effect on the luster of the yarn. This is carried out, wherever the expense of it is warranted, in the customary way by

preparing a bath of about 60 gallons of water, for each 100 pounds of yarn, containing two pounds of sodium peroxide, and, upon the latter entering into solution, adding 2¾ pounds of sulphuric acid contained in 30 gallons of water, and, finally, either about 4 ounces of silicate of soda, or a sufficient quantity of ammonia to render the bath alkaline. The material is steeped in the bath, which is at first cold, and the temperature then gradually raised to 140 degrees Fahrenheit, and maintained at that for two or three hours.



Mercerizing Machine for Beam Warps.

or until the warps are sufficiently white. They are finished off by washing, soaping, and washing.

The other form in which warps are mercerized directly from the beam, is a very rational and, moreover, successful mode of operating, and appears to be increasing in favor. Some well substantiated claims for its superiority over the rope-form have been advanced, and these are bound to appeal for consideration in those circumstances where the treatment of stock warps or sectional beamed warps is concerned.

A view of a machine for mercerizing a warp directly from a beam is shown in Fig. 4. From a general point of view, this machine is no more than an ordinary slasher sizing machine modified in places to suit the requirements. The modification consists in dispensing with the sizing trough usually situated between the beam creel and the drying cylinder, and providing instead a series of specially constructed tanks through which the yarn may pass for the purpose of mercerizing. These tanks are constructed of iron, with the necessary guiding rollers and a series of squeezing rollers. The number of tanks provided varies according to the nature of the work; in some instances the number may be increased so as to admit of dyeing and of sizing continuously, as well as mercerizing.

It is reasonably and justifiably claimed that warps so treated throughout in the full width from the beam, and thence on to a beam, submit much more readily to thorough and uniform impregnation with the alkali than is possible by treating in the compact and somewhat twisted rope form. For the same reason the yarn is more readily freed of alkali in the subsequent course of washing. Not the least valid claim is the economy of the method in saving the cost of the rather expensive process of "dressing." Perhaps something is also gained in the degree of luster resulting. From a practical point of view, considerable care and attention is also required with this machine in regulating the squeezing rollers for the purpose of securing the right amount, and not too much, of tension exerted on the thread.

It can reasonably be repeated that the most successful, and the most certain manner of gaining this objective, rests in varying the diameters of the bottom rollers of the respective sets of squeezing rollers. The diameter of the roller taking up the yarn as it leaves one compartment should be slightly greater than that of the one delivering the yarn into the same compartment. As it has already been pointed out, very careful discrimination needs to be exercised in properly regulating the ratio between the diameters of two such rollers, for it is a very notable fact that different qualities of yarn, and different counts, can not be all successfully treated under the same degree of tension, as it is controlled in this manner. The conditions are modified to suit the requirements by varying this ratio one way or the other by increasing or decreasing the diameter of one or other of the bottom squeezing rollers simply by winding round more cloth-lapping or by removing cloth.—Textile Recorder.

Size must be varied for hard or soft twist yarns. It should be thinner for hard twist than for soft twist yarn, as the latter absorbs it more readily. Penetration of the fiber by the size is necessary for good yarn.

Short-stapled cotton lusters badly in mercerizing, because it must be more tightly twisted. The best luster of all is obtained with two-fold twist, in which the outer fibers lie parallel to the axis, and the yarn should be well singed to remove projecting fibers.

PRIZE CONTEST LETTERS.

Editor's Note: Attention is called to the fact that the Prize Letter Contest closes on May 1, 1910. Letters bearing postmarks up to and including that date will be entered in the contest, but we advise all who expect to send letters to have them in our hands as soon as possible, as it will facilitate matters in this department and lessen the possibility of error. There are 39 separate prizes to be given away, which constitute the greatest aggregate value ever offered by a textile paper. The descriptions of the prizes are given on page 148. The names of the winners will be published in the June number and the prizes will be forwarded immediately after the judges' decisions have been made.

NEW COTTON IN THE MILL.

In the January number of Cotton there appeared an article on "New Cotton in the Mill," which I read with much interest, and more so than usual to me, inasmuch as some statements were made that were new to me, and I think they would strike most of the old heads in the business, as being new ideas. With this in view I would offer my ideas along the same line, but may find myself differing with Mr. Edmondson, in reaching the results we all wish to attain. In the first connection I wish to state, that, in my forty years of experience and actual labors in and about the cotton mill, as an all-round spare hand, second hand, overseer carding and spinning, and other high positions, and now in the harness, I never heard of any objections to the mixing of new cotton with old. The fact is that I have always done this and, so far as I know, every mill man does it if possible, and wants to do it, if the new cotton is bought, and is at the mill, before the old runs out.

I have tried both ways, and have always had less trouble when mixing the new with the old, than when I was obliged to put all new cotton in at once. I will add, however, that I never found anything very serious in either way. The only trouble I ever had was when putting in new cotton that was green, that is, not quite as dry as old cotton. It would dry out somewhat in going through the carding department and come out light unless it was watched closely until a standard was established. That is to say, if the railway sliver on old cotton weighed 110 grains, the new cotton might not, and I usually had to put the weight up to 112 or 114 grains, and in the course of one or two months, would have to bring it down gradually to 110 grains again. If the English system of carding is used this would have to be done on the drawing or slubber, depending on where the changes are made.

By all means do not try to keep the numbers in the picker by having the laps weigh more or less according to the yarn; it takes too long to get the laps into yarn to try to keep numbers at this point. But do not neglect the weight of the laps, no matter what system of carding is used. Have a standard and keep the weight there. Weigh every lap that is taken from the finisher pickers, and if any is one pound from the standard, run it over again. I keep a pair of scales at the finisher picker, and every lap taken from these machines is weighed, and the weight put on a slate, where it can be seen by the overseer, second hand, or any one who has business to know about how things are going. Don't the picker help deceive us in this? Oh, yes, and we find it out at some point down in the carding room.

My experience with new cotton has been quite at variance with Mr. Edmondson's, as to the bother and worry about it. He says it makes more waste, and does not run as well, especially on the cards. If he has fully tested this, then he knows; but if he has not made any tests on cards with new cotton and old, then he has not the facts, except in a general way. I think we agree that new cotton is not quite as dry or seasoned as old cotton; just how long it takes for new cotton to become old, and seasoned, Mr. Edmondson does not tell us. But my experience has been that new cotton does not clean as easily through the picker or cards, and free itself from moats, leaf, and the foreign substance we want to take out, as well as does old cotton fully seasoned, hence the statement that more waste is made on new cotton than old, does not meet with my experience. I think that almost all, if not quite all carders and superintendents will agree with me.

But it is here that new cotton does not run quite as well, because it is not cleaned quite as thoroughly as it would be after it aged a little. The time required for new cotton to become old cotton depends upon where it is stored. If in a basement or celler, it will not work as well as if stored in a high and dry house, where the air can carry off the moisture, and circulate around it. In the latter case, new cotton will become old cotton in three months; that is, cotton ginned and baled in October or November, will work as well as it ever will, in January, or February, if when opening, it is opened up light and the compression taken out of it.

In the article referred to, it was stated that new cotton will spin heavy if mixed with old cotton and often kinky filling will be made because it does not draw evenly. Now one of my strong points is, that to mix new cotton with old will cause less trouble than to run new cotton in alone. The article stated that a drying out test on new and old cotton showed 9.7 per cent. moisture from new cotton, and only 5½ per cent. moisture from the old. I don't know of any statement I can make that will substantiate what I have stated in this paper, more than this point.

Kinky filling is a source of annoyance with all weavers, and is found in almost all weaving mills. But don't blame it onto the cotton all the time; and when new cotton arrives in the mill, don't say, "Now we are going to have trouble," for as soon as the carder and spinner get this notion into their heads, it gets to the weaver, and he finds the trouble before the new cotton gets to his department. Like one weaver I knew, who told me in confidence that he never told the spinner or carder that his work was running well, for fear they would not be on the look out to make the best they knew how. Kinky filling is caused by excessive twist, and most mills make it with the twist they wish, and then make it weave properly by steaming, or conditioning of some kind.

Sometimes kinky filling and cockly yarns are made by

having some long staple cotton. There are but few bales of cotton of the first pickings in which we can not find long staple cotton; not much perhaps, but more than one would imagine, unless they have looked into this subject. At one time I worked for a company that used 1,400 bales of cotton per week. We had some combers for making a nice grade of 50s yarn, and the idea was to comb the Texas staple, and select the cotton for it from the best of these 1,400 bales used weekly. There was an inspector whose business it was to be in the picker room of the several mills and see every bale opened, and select as long staple cotton as he could from these 1,400 bales. To our surprise we found enough cotton to supply the combers, that ran 1⅛ to 1¼ inch staple. There would be all the way from 25 to 125 pounds per bale of this cotton, in enough of the bales opened to give the mill all the long staple needed. We had always been getting more or less long staple in this way, but did not know that it amounted to such a large proportion. I used to find the long staple in the cockly yarn, or kinky filling, but I do not say that all of this kind of yarn is made from long staple cotton; but a lot of it is.

Our company used to buy round lots of cotton from strict middlings to ordinary, and we would find the majority of this long staple in the lower grades. In my experience as overseer of carding, when in the mill I was never away from the picker room when cotton was opened and I gave as close watch to the cotton opened as was possible, that I might know just what kind of cotton was coming to me. I used to find this long staple cotton, and would have it scattered over the pile, so that but little would get into any part of the work; and whenever there was kinky filling or cockly yarn, I felt very sure of what made it. I did that way in a mill that was producing 70,000 pounds weekly, and only once during six years did the spinner ever find any cockly yarn, and never any kinky filling, as it was all steamed and conditioned before weaving.

I wanted to get into this article some tests I have made in the picker room on both very new cotton and old cotton, as to the per cent. of waste made at this point, but will have to take this up later, for Mr. Edmondson's 2.7 per cent. waste in the picker is too low, and I can not see how that any cotton, even strict good middlings, can get out of the picker with only 2.7 per cent. The last clause of the letter does not back up his article, wherein he says, "This fault is usually a slight one though, and the writer would not recommend any change in the lay out to remedy this defect." Now my idea is, if there is any fault, however slight, remedy it.

MANAGER.

SETTING THE HARNESSES ON DOBBY LOOMS.

BY J. T. M.

The operation of the harnesses for forming a shed for fancy goods, on dobby head looms, is quite different from that on cam looms, as the cam attachments are actuated under the loom, while in the dobby loom, the mechanism is attached above and to one side of the loom. The harnesses are operated by the dobby mechanism, which is actuated in some instances by the dobby driving gear, this being driven through suitable gears from the crank shaft gear. The harnesses are raised and lowered by the operation of the harness jacks of the dobby, which are operated through the hooked jacks by the pump-rod in due turn as the said hook jacks are raised and lowered by the operations of the pegs and spaces in the pattern chain. The pump-rod is coupled on to one end of the cam shaft directly under the dobby, the top end of the pump-rod working on a stud set in the rocking lever of the dobby.

To set the harnesses on this kind of work the following method is usually found the best: Drop all the harnesses to the lowest position, and turn the crank shaft to rest on its back center. First, regulate the wires, attached to the harness jacks, in this manner: Suppose you are setting harnesses for producing an 8-harness fabric, set the first and second wires attached to the first and second jacks at one end, and the first and second harnesses at the other, in the first or lowest notches of their respective jacks; and the wires for the 3rd and 4th harnesses in the second notches of their respective jacks, and so on, raising one notch higher for every two harnesses, until all are adjusted, thus raising the wires one notch higher for every 2 or 3 harnesses as you go further away from the fell of the cloth. This gives a longer leverage on the successive harnesses towards the rear, which is necessary so that those farther from the fell of the cloth can be raised higher and thus form an even shed with the threads carried by the front harness when they are raised and lowered together.

The next point in setting the harnesses is to see that none of them are bearing on their respective warp threads too heavily so that the latter bend over the race-plate; neither must they sit too high above it. To set the harnesses, bring the first harness against the back of the race-plate, and see that the upper portion of the harness eyes are just a little above the level of the race-plate. After your first harness is set correctly, set each following harness a little lower than the preceding one, until they are all set. When they are set in this manner a more even shed is formed because the further the harnesses are from the race-plate, the lower they have to be set in order to gain the same position in relation to the race-plate when depressed, as to the forward harnesses.

To set the shed to open at the right time to receive the shuttle as it is thrown from the box, to pass freely across to the other box, bring the loom reed forward until it is within about two inches of the fell of the cloth; then loosen the set screw that attaches the coupling to the cam shaft which operates the pump-rod, turn the coupling around the shaft until the rocking lever of the dobby is in an upright or vertical position, then tighten up the set screw again. If after being set in this manner the harnesses do not work right, there must be some defect in the tuning of the dobby with the loom.

A CARDER'S TROUBLE.

BY A. J. T.

The card room has a lot of trouble in damp weather, and it generally occurs in the opening or mixing room. The mixing room is located in a majority of the mills in one section of the warehouse which is generally a brick building with from two to four doors and from four to six windows. In the South, colored labor is used in the mixing room with one white man and as a rule none of them know anything about carding cotton. They will keep

the door and windows standing open, unless it is raining, and will open them again as soon as possible. I had just as soon have my warehouse doors and windows open while it is raining as to have them open while the air is damp. The damp air is what makes the work run bad on the card.

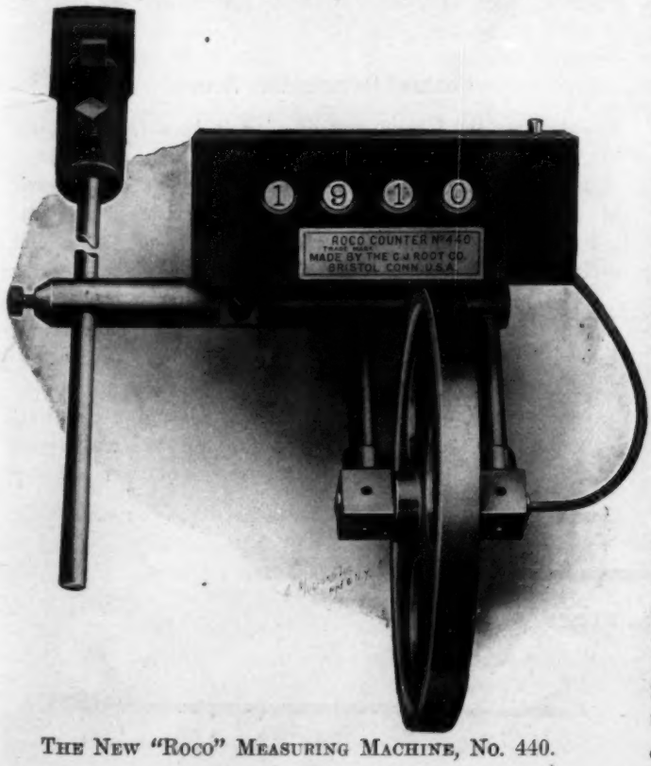
Some mills have a tin pipe through which to blow the cotton from the mixing room to the opening room. This pipe is sometimes shaken by the vibrations in the mill until the joints are cracked. The damp air will then get into the pipe and on the cotton; and where cotton is exposed to the damp air and gets more or less saturated, there is no way to make the work run properly except to put hot air in the room to dry the cotton. In the summer the weather is too hot to heat the room. The only remedy is to keep the doors and windows closed in damp weather and keep the damp air away from the cotton. Sometimes a carder will keep his room closed in damp weather, but the spinning may be on the same floor, and they will keep their windows open. That condition will leave damp air into the card room. Some spinners keep their windows open in rainy weather.

My work once began to run badly in dry weather. The cotton ran just like it was damp, so I went to the mixing room. The man looking after the cotton said it was dry and all right. The cotton, however, had been stacked in a warehouse for about six or eight months, and I found that the bales next to the floor had gotten damp, some of them gaining as high as 35 pounds, and none of them less than 15 pounds. I took those bales next to the floor and dried them, and my troubles were soon over. The reason I wrote on this subject was because I have seen so many carders having this same trouble, and they did not seem to know that the damp air that came in at the windows would cause this trouble. I would like to hear from some old and experienced overseer on the subject of managing help.

NEW MACHINERY AND TRADE NOTES

THE NEW "ROCO" MEASURING MACHINE.

The C. J. Root Co. of Bristol, Conn. has adopted the trade mark, "Roco" for its counters for measuring textile goods and similar materials in the process of manufacture. In the new Roco No. 440, shown in the accompanying illustration, the measuring wheel may be the unit for 12 inches or from that to 36 inches. The connection between the measuring wheel and counter by means of a flexible shaft permits the location of the dial in any position. The counter is reversible and can be run backward as well as forward. This feature allows errors to be corrected and allowances made with great accuracy. The dial is full geared and can be reset at any time. The counter can be connected directly to the shaft if desired. For many uses it is said that these counters are better than those operated with a reciprocating motion.



THE NEW "ROCO" MEASURING MACHINE, NO. 440.

THE NO. 50 UNIVERSAL WINDING MACHINE.

This machine is especially adapted for winding soft yarn in conical form to be used on knitting machines. The accompanying illustration shows a "Nutaper" cone made by a special coning attachment on this machine. In winding the soft yarn for hosiery, retention of its elastacity and uniformity of twist are of the utmost importance. The universal system does not crush and crinkle the yarn or disturb its twist. A particularly delicate handling of the yarn is effected through the use of an automatic tension device and an automatic pressure device. When any extra resistance is caused on the supply bobbin, the tension mechanism relaxes, so that the yarn is never subjected to strain. The applied tension on the yarn being wound decreases automatically with the increase in the size of the cone, thus allowing for the additional tension accruing from the increase in speed of the delivering yarn. The pressure applied in winding is very light, and decreases automatically as the cone increases in diameter.

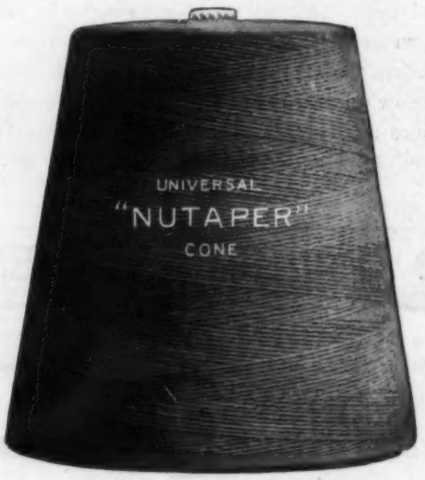
There are no single tight wraps of yarn in a "Universal" cone, nor undue constriction of the outer layers upon the inner mass. There is no crushing, crinkling, or stretching of the yarn, and no rolling or slipping at the ends of the traverse. By slight changes in the equipment of the machine, it can be adapted for coning or doubling two and three ends up.

An important feature of the No. 50 machine is the automatic lubrication of all of the bearings. The oil flows from two supply reservoirs in each machine, constantly and uniformly through the bearing, back to the reservoirs, and so on, thus making a continual circulation of the lubricant. All of the pulleys are supplied with reservoirs which contain oil sufficient for several months' running. As the oil is used repeatedly, it is only at long intervals that it needs to be renewed in the reservoirs. All of the bearings are dust and lint proof, so that the outside of the machine can

not become smeared with oil, and danger of soiling the yarn while winding is removed. The points of advantage claimed for the "Nutaper" universal cone with special reference to its use on knitting machines are as follows:

1. The yarn retains its original elasticity and even twist because (a) by the "Universal system" it is wound with a light tension and not subjected to the rubbing pressure of a friction drum. (b) The guide delivers the yarn at the cone itself and does not draw it on with a rolling motion from a greater distance than the length of the fiber.

2. "Nutaper" cones can be ordered with any desired



Nutaper Cone, Made on a Universal Winder.

degree of "openness;" the correct "spacing" once being determined remains absolutely uniform for any number of cones and for all the layers of any one cone.

3. All of the yarn will run off "clean" because (a) the taper or pitch is correct, having been determined by exhaustive tests on a great variety of knitting machines. (b) The paper cone tube has the same acute taper or pitch as the outer surface of a full cone and there is no "drawing in" or "bunching" of the first few coils. (c) No. 50 "Universal" machine does not make "cobwebs" or "overruns."

THE PAGE LATCH NEEDLES.

The Page Needle Co., Chicopee Falls, Mass., is one of the oldest concerns that manufactures latch knitting needles, the business having been established in Canada in 1866. It was removed to Chicopee Falls in 1869. Many thousand varieties of latch needles are manufactured to meet the demands of all mills which manufacture full-fashioned hosiery and the finest underwear.

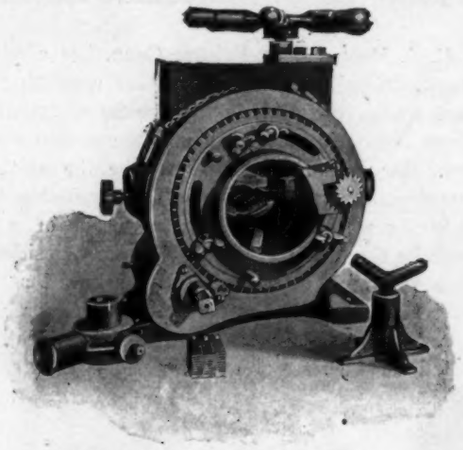
The accompanying illustrations show three of the most widely used styles of needles.

FORBES' PATENT DIE STOCK.

The accompanying illustration shows a pipe cutting and threading machine which has been placed on the market by the Curtis & Curtis Co., Bridgeport, Conn. The machine is designed to cut off and thread all sizes of wrought iron pipe from 4 to 14 inches inclusive, a range of sizes, which, it is claimed, is larger than cut by any other machine ever placed on the market.

The machine consists of a die-carrying gear, supported in a casing or shell, with the pinion imbedded in its side. On the back of the gear is placed a lead screw, of the same number of threads to the inch as the pipe to be cut, which engages with the brass lead blocks, shown on the side of the shell, and which work out or in by an eccentric.

Thus as the gear revolves in the shell, it is drawn back into the casing by the lead screw, and the dies are brought onto the pipe. In operating the machine, the pipe is placed through the self-centering vise attached to the back of the machine, with the end to be cut against the back of the dies, and securely clamped by turning the hand-wheel, shown on the top of the machine. There are opening dies which are adjustable to any variation of the fittings, by means of cams behind the dies on an annular ring,



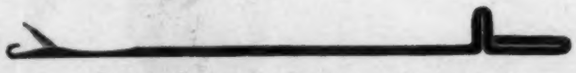
Forbes' Patent Die Stock.

and they are set for the size of pipe to be cut, by turning the ring to the corresponding graduation. In cases where it is desired to cut left-hand threads as well as rights, or casing or other threads as well as standard threads, the machine is built with a pressure feed, instead of a lead screw.

The advantages for this machine are that it has an unusually large range; requires the minimum of floor room; takes little power to run it; and it is simple in construction. It is portable, and can be carried from place to place, and pipe cut on the spot without the delay and expense of carrying it to the machine. By means of the small pinion working on the large gear, great power is obtained, so that

Page's Long Shank Needle, Style XX.

Page's Crooked Shank Dial Needle, Style S. & W. 6X.



Page's Standard Cylinder Needle.

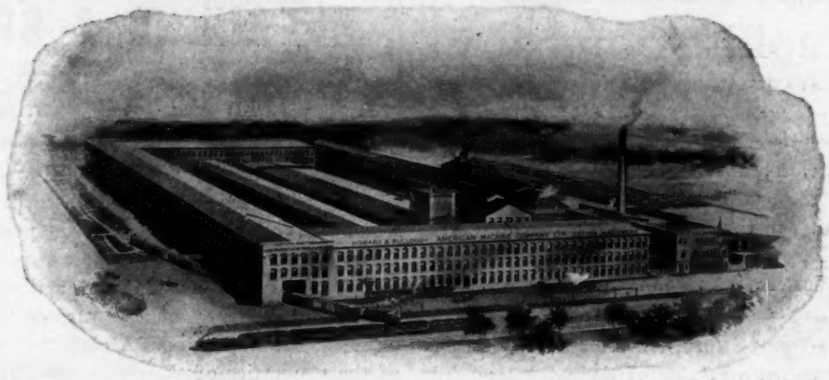
C. E. RILEY, Treas.
Boston Office
65 Franklin St.

HOWARD & BULLOUGH
American Machine Company, Ltd.
PAWTUCKET, R. I.

Southern Offices
814-816 Empire Bldg.,
Atlanta, Ga.

COTTON MACHINERY

ARE YOU INTERESTED TO KNOW WHAT IS THE BEST?



SEND FOR OUR DESCRIPTIVE CIRCULARS WITH LISTS OF USERS.

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SLUBBING FRAMES
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ROVING FRAMES

IMPROVED SPINNING FRAMES
TWISTERS
CONE WINDERS
WARPERS and SLASHERS

WE INVITE YOUR INVESTIGATION AND COMPARISON.

a pipe as large as 14 inches can be threaded by one man with ease, while on 2-inch and 3-inch pipe, a boy will do the work with only one hand on a crank. These machines are comparatively light being complete in themselves. If the pipe is at the bottom of a trench, and only one end exposed, the machine can be slipped on and the thread cut, without moving it from the ground. If it is desired to have a power machine, it is fitted with a power base and countershaft, which allows it to either be used as a power machine in a shop or taken from the base and carried on outside work as a hand machine.

THE EXCELLENT BUSINESS reported by the manufacturers of the HYGROSSO since its introduction in the latter part of the year 1908, would indicate that this humidifier is an evident success. The Hygrosso has taken its place among the leading apparatus of this character, because it fills an important requirement of the textile manufacturers, and has demonstrated that its simple and durable construction, satisfactory service and economical operating cost is appreciated by mills that are competent to judge.

The main arguments set forth to recommend the HYGROSSO humidifiers include simple and durable construction, low cost of operation and upkeep, minimum attention for satisfactory operation, and excellent service. It is pointed out that simple and well built machinery always lasts longest and gives the least trouble. Realizing these important points, the HYGROSSO manufacturers are giving particular attention to constructing these humidifiers to meet the hard service to which they will be subjected in practice. Some improvements have been made in certain lines to obtain stronger construction and guard against the possibility of any trouble with the apparatus itself.

A simple arrangement of piping for the water feed to humidifiers has also been devised to insure a constant and even feed to the heads. This arrangement overcomes any troubles which may develop where water is used from a supply which varies in pressure. It also prevents flooding the humidifiers to cause wetting or depositing spray on the floor or the machinery. While the Hygrosso stands alone as the only humidifier with all working parts exposed to view, requiring no opening for cleaning, a special construction for operating in carding rooms has been developed which prevents to a great extent the accumulation of fly on the working parts. This construction is only found necessary however in rooms containing an excessive amount of fly. Among the recent orders for Hygrosso may be mentioned the following:

The Banna Mfg. Co., Goldville, S. C.; Buffalo Weaving & Belting Co., Buffalo, N. Y.; John S. Boyd & Co., Williamstown, Mass.; The Fort Mill Mfg. Co., Fort Mill, S. C.; The New Berlin Silk Mfg. Co., New Berlin, N. Y.; The Colonial Mfg. Co., Philadelphia, Pa.; Nims Mfg. Co., Mt. Holly, N. C.; W. A. Lush Silk Co., Scranton, Pa.; Albion Cotton Mills, Mount Holly, N. C.; Mount Holly Cotton Mills, Mount Holly, N. C.; and The Stanley Creek Cotton Mills, Stanley Creek, N. C.

DRAPER CO., HOPEDALE, MASS., in the February issue of "Cotton Chats" gives some very interesting notes from the reports of one of its traveling men who visited a number of mills using Northrop looms. The report showed that the average production of the mills visited was 100 to 105 per cent., the looms being run during the noon hour. In one

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Write for color schemes to the
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LOWELL, MASS.
FRANK B. KENNEY, Manager
Traverse Wheel and Long Roll Grinders
REPAIRING A SPECIALTY
J. H. MAYES, Southern Agent

mill running on print cloth, nine different weavers were running 36 looms each. The pamphlet also gives the number of Northrop looms running in the United States, including orders to January, 1910. The New England States contain 58,838, Middle and Western States 4,070, and the Southern 108,447 looms.

Saco & Petee Machine Shops, Newton Upper Falls, Mass., have recently issued a catalog of their spoolers and reels, including parts. Production tables are given, and the parts are illustrated, having numbers for reference. A copy of this catalog may be had by addressing the home office.

The Carlyle Johnson Machine Co., Chelsea, Conn., has issued a catalog describing its Johnson friction clutch patented, and also pointing out several uses in connection with counter shafts and line shafts. The catalog is fully illustrated and gives some very valuable information in regard to this clutch.

Otis Elevator Co., New York City, in a recent issue of the "Indicator," gives a discussion of "The Problem of Vertical Transportation," and other interesting articles.

The Wiregrass Country is the name of a monthly journal of thought and information about wiregrass Georgia. It is published in Fitzgerald, Ga., and every issue contains articles on the advantages of that section, and also shows the wonderful progress and development through that belt.

Morris Machine Works, Baldwinsville, N. Y., have issued a 1910 catalog on their centrifugal pump machinery, which are made in different types to suit all kinds of that class of work. The catalog is profusely illustrated, showing many of the different types, and giving valuable information in regard to the product.

H. A. Metz & Co., New York City, sole agents for Farbwerke vorm. Meister Lucius & Bruning, have published in three large bound volumes a treatise on their dyestuffs, which is probably one of the most complete and instructive works ever prepared by a dyestuff concern. The three volumes are divided into four parts, as follows: Part 1 consists of fastness tables with dyed samples to illustrate the shade of each individual dyestuff and to compare with their fastness properties. The tables refer to Basic and Janus colors, Dianil Colors, Thiogene Colors, Indigo, Mordant (Alizarine) Colors, Resorcine and Azo Colors, Colors produced by a process of oxidation, Colors produced by condensation, and insoluble Azo Colors produced on the fiber.

Part 2 describes in a general manner the various modes of application of the different color groups mentioned, and deals in particular with the dyeing of Indigo, the employment of Mordant Colors, and the production of insoluble Azo colors on the fiber. These two parts are contained in Volume I. Volume II contains a portion of Part 3, and shows a large number of patterns, and classifies the colors according to their suitability for the various branches of the cotton industry; and the various methods of dyeing by machines are illustrated. A classified synopsis is first given of the properties of the cotton dyestuffs made by this concern, afterward entering into a discussion of the dyeing of cotton in its raw state, cotton yarn dyeing and cotton yarn printing, and cotton piece dyeing. Volume III continues Part 3, giving recipes for patterns produced on a large scale, taking up 26 different materials manufactured from cotton, such as calico, linings, book bindings, artificial flowers, velvet, hosiery, curtain materials, etc. The dyeing of other vegetable fibers is then taken up, including linen, hemp, jute, straw, etc. Samples of all of the different dyed materials are given throughout the work. Part 4 surveys the processes of bleaching, mercerizing, etc., and deals in tabulated form with those chemicals that are generally used in cotton dyeing. A great many important tables are included in this part.

The Dannerth Laboratory. The Laboratory of Industrial Chemistry conducted in Philadelphia by Dr. Frederic Dannerth, has extended its field of usefulness to such a degree that it has become necessary to find larger quarters. The consultation offices are now located at 222 Walnut Street, Philadelphia. One department which has attained to considerable importance is that dealing with legal and official chemistry. This includes expert testimony before courts of law and the preparation of special reports for the same; chemical testimony and laboratory examinations for importers and brokers (customs house cases); the preparation of chemical patents and the investigations necessary for patent litigation; and special examinations in cases involving marine and fire insurance. In addition to his regular practice he takes an active interest in industrial education, and the Kensington Association Institute of Philadelphia has received many cash donations from him.

Graphoil Lubricator Sales Co., 90 West St., New York City, has issued a pamphlet on lubricating specialties feed, describing the lubricator used for supplying graphoil to steam cylinders, etc. It is claimed that with graphoil lubricator the oil consumption is reduced 50 to 75 per cent., with a decided horsepower increase. The oil in the boiler feed is reduced and the wear and tear of the engine and boiler are reduced. Furthermore it is protection and prolongs the life of packing, insures lubrication should the oil